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Class _____ *No.* _____

IN EXCHANGE.

93.10

TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

SIXTEENTH SESSION,

HELD AT PHILADELPHIA,

JUNE 5, 6 AND 7, 1902.

APPENDIX.

THE PUBLISHED WRITINGS OF THE PRESENT ACTIVE MEMBERS. REFERENCES TO ORTHOPEDIC LITERATURE PUBLISHED FROM MAY 1, 1900, TO JULY 1, 1902.

VOLUME XV.

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The Association does not officially endorse the opinions presented in the different papers published in its TRANSACTIONS.

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LIST OF OFFICERS.

[Elected June 7, 1902.]

PRESIDENT.

L. A. WEIGEL, M.D.

VICE-PRESIDENTS.

R. H. SAYRE, M.D.
R. TUNSTALL TAYLOR, M.D.

TREASURER.

E. G. BRACKETT, M.D.

SECRETARY.

JOHN RIDLON, M.D.,
103 State Street, Chicago.

COMMITTEE ON MEMBERSHIP.

A. J. STEELE, M.D. (*Ch'n*). W. J. TAYLOR, M.D.
A. THORNDIKE, M.D. H. L. TAYLOR, M.D.
A. B. HOSMER, M.D.

EXECUTIVE COMMITTEE.

The President, the Treasurer, and the Secretary.

PUBLICATION COMMITTEE.

J. E. GOLDTHWAIT, M.D. (*Ch'n*). H. AUG. WILSON, M.D.
JOHN DANE, M.D.

MEMBER OF EXECUTIVE COMMITTEE, CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS.

W. R. TOWNSEND, M.D.
Alternate: R. W. LOVETT, M.D.

LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M. SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.
1892. BENJAMIN LEE, M.D.
1893. A. J. STEELE, M.D.
1894. A. M. PHELPS, M.D.
1895. JOHN RIDLON, M.D.
1896. ROYAL WHITMAN, M.D.
1897. SAMUEL KETCH, M.D.
1898. R. W. LOVETT, M.D.
1899. W. R. TOWNSEND, M.D.
1900. H. M. SHERMAN, M.D.
1901. A. J. GILLETTE, M.D.
1902. H. AUGUSTUS WILSON, M.D.
1903. L. A. WEIGEL, M.D.

LIST OF MEMBERS.

* Original Members.

1901. Bartow, Bernard, M.D. Clinical Professor Orthopedic Surgery, Medical Department, University of Buffalo; Orthopedic Surgeon, Children's Hospital; Orthopedic Surgeon, Erie County Hospital; Consulting Orthopedic Surgeon, Buffalo General Hospital. 481 Delaware Avenue, Buffalo, N. Y.

1892. Blanchard, Wallace, M.D. Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 34 E. Monroe Street, Chicago.

1889. Brackett, E. G., M.D. Assistant Surgeon to the Children's Hospital. 166 Newbury Street, Boston.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Children's and the Good Samaritan Hospitals; Assistant Professor of Orthopedic Surgery in Harvard Medical School. 133 Newbury Street, Boston.

1889. Burrell, Herbert L., M.D. Visiting Surgeon to the Boston City Hospital; Visiting Surgeon to the Children's Hospital; Assistant Professor of Clinical Surgery, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. Visiting Surgeon to the Hartford Hospital; Consulting Surgeon to Litchfield County Hospital. 340 Farmington Avenue, Hartford, Conn.

1893. Coolidge, Frederic S., M.D. Demonstrator of Surgical Appliances in Rush Medical College; Professor of Orthopedic Surgery, Chicago Post-Graduate Medical College; Attending Orthopedic Surgeon to the St. Luke's and St. Elizabeth's Hospitals; Attending Physician to Children, Presbyterian Hospital. 103 State Street, Chicago.

1895. Dane, John, M.D. Junior Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the West End Infant Hospital. 29 Marlborough Street, Boston.

1897. Davis, Gwilym G., M.D. Univ. of Penna. and Goettingen, M.R.C.S. Eng. Surgeon to the Philadelphia Orthopedic, Episcopal, and St. Joseph's Hospitals; Assistant Professor of Applied Anatomy, University of Pennsylvania. 255 South Sixteenth Street, Philadelphia.

1900. Elliott, George R., M.D. Orthopedic Surgeon to Montefiore Home for Chronic Invalids. 48 East Twenty-sixth Street, New York.

1902. Fitzhugh, P. Henry, M.D. Instructor in Orthopedic Surgery, New York Polyclinic; Chief of Clinic and Instructor in Orthopedic Surgery, Cornell Medical College; First Assistant Surgeon in New York State Hospital for Crippled and Deformed Children. 36 West Thirty-fifth Street, New York.

1901. Freiberg, Albert H., M.D. Professor of Orthopedic Surgery in the Laura Memorial Women's Medical College; Orthopedic Surgeon to the Cincinnati, Presbyterian and Jewish Hospitals. 706 Walnut Street, Cincinnati, Ohio.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital; Visiting Physician to the Avon Home for Children; Visiting Physician to St. Luke's Home for Children. 8 Elwood Avenue, Cambridge, Mass.

1899. Galloway, H. P. H., M.D. Surgeon to the Toronto Orthopedic Hospital; Orthopedic Surgeon to the Toronto Western Hospital; Orthopedic Surgeon to Grace General Hospital, Toronto. 12 East Bloor Street, Toronto, Canada.

*1887. Gibney, V. P., M.D. Clinical Professor of Orthopedic Surgery in the College of Physicians and Surgeons, Medical Department of Columbia University; Surgeon-in-Chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Children's Hospital and to the Montefiore Home and Hospital, New York. 16 Park Avenue, New York.

*1889. Gillette, Arthur J., M.D. Professor of Orthopedic Surgery in the Minnesota State University; Orthopedic Surgeon to St. Luke's, St. Joseph's, Bethesda, City and County Hospitals, and the St. Paul Free Dispensary, and Consulting Orthopedic Surgeon to Asbury Hospital; Surgeon-in-Charge of Minnesota State Hospital for Crippled and Deformed Children. 301 Pleasant Avenue, St. Paul, Minn.

1892. Goldthwait, Joel E., M.D. Orthopedic Surgeon to Carney Hospital; Consulting Orthopedic Surgeon to the Massachusetts

General and the New England Hospitals; Assistant Surgeon to the Children's Hospital. 372 Marlborough Street, Boston.

1892. Griffiths, J. D., M.D. Lieutenant-Colonel and Medical Director First Brigade, National Guard of Missouri; President of the Association of Military Surgeons of the U. S.; Surgeon to St. Joseph's Hospital, Kansas City; Consulting Surgeon to the German Hospital, Kansas City; Consulting Surgeon to the Kansas City, Fort Scott, and Memphis R. R. Southwest corner Ninth and Grand Avenue Kansas City, Mo.

1898. Hoffmann, Phil., M.D. Clinical Lecturer on Orthopedic Surgery in the Medical Department, Washington University; Chief of the Orthopedic Clinic at St. John's Hospital. 705 North Channing Avenue, St. Louis, Mo.

1899. Hopkins, W. Barton, M.D. Visiting Surgeon to the Pennsylvania Hospital. 1904 South Rittenhouse Square, Philadelphia.

1893. Hosmer, A. B., M.D. Orthopedic Surgeon to St. Luke's Hospital. 103 State Street, Chicago.

*1887. Judson, A. B., M.D. Orthopedic Surgeon to the Outpatient Department of the New York Hospital. 1 Madison Avenue, New York.

*1887. Lovett, Robert W., M.D. Surgeon to the Infants' Hospital; Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the Boston City Hospital. 234 Marlborough Street, Boston.

1893. McCurdy, Stewart Le Roy, A.M., M.D. Orthopedic Surgeon to the Presbyterian Hospital and East End Dispensary; Professor of Anatomy and Oral Surgery, Pittsburg Dental College; Dean of Pittsburg School of Anatomy. 515 Pennsylvania Avenue, Pittsburg, Pa.

1889. McKenzie, B. E., B.A., M.D. Surgeon to the Toronto Orthopedic Hospital; Orthopedic Surgeon to the Grace General Hospital; Associate Professor of Clinical Surgery, Ontario Medical College for Women. 12 East Bloor Street, Toronto, Canada.

1901. McKim, Smith Hollins, M.D. House Surgeon to the Hospital for the Relief of Crippled and Deformed Children; Chief of Clinic to the Professor of Orthopedic Surgery, University of Maryland. 2000 N. Charles Street, Baltimore, Md.

1889. Myers, T. Halsted, M.D. Attending Orthopedic Surgeon to St. Luke's and New York Foundling Hospitals; Attending Surgeon to the New York Orthopedic Dispensary; Consulting Surgeon to St. John's Riverside Hospital, Home of the Annunciation, and New York Lying in Hospital. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the Denver College of Medicine; Orthopedic Surgeon to the Arapahoe County Hospital. 732 Fourteenth Street, Denver.

1899. Painter, Charles F., M.D. Instructor in Orthopedic Surgery at Tufts Medical School; Visiting Surgeon to the House of the Good Samaritan; Assistant Orthopedic Surgeon to the Carney Hospital. 372 Marlborough Street, Boston.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Departmnt of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1900. Peckham, Frank E., M.D. Orthopedic Surgeon to the Rhode Island Hospital. 266 Benefit Street, Providence, R. I.

1901. Pegram, John C., Jr., M.D. Orthopedic Surgeon to St. Joseph's Hospital and to the Rhode Island Catholic Orphan Asylum; Orthopedic Surgeon to the Rhode Island Hospital; Consulting Surgeon to the Butler Hospital for the Insane; Demonstrator of Anatomy, Brown University. 277 Benefit Street, Providence, R. I.

1890. Phelps, A. M., M.D. Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon and Surgeon-in-Charge of the Orthopedic Department of the Post-Graduate Hospital, New York; Visiting Surgeon to the City Hospital, New York; Surgeon to the Daisy Field Hospital and Home, Englewood, N. J. 62 East Thirty-fourth Street, New York.

1901. Porter, John L., M.D. Professor of Orthopedic Surgery, College of Physicians and Surgeons (Medical School of University of Illinois); Assistant Attending Orthopedic Surgeon, Home for Destitute Crippled Children; Attending Orthopedic Surgeon, St. Luke's Dispensary. 103 State Street, Chicago.

*1887. Ridlon, John, M.D. Professor of Orthopedic Surgery in the Northwestern University Medical School and Northwestern University Women's Medical School; Senior Attending Orthopedic Surgeon to St. Luke's Hospital and Michael Reese Hospital; Orthopedic Surgeon to the Wesley Hospital and the Evanston Hospital;

Surgeon-in-Charge of the Home for Destitute Crippled Children; Orthopedic Surgeon to the Chicago Hospital School; Consulting Orthopedic Surgeon to the Mary Thompson Hospital for Women and Children. 103 State Street, Chicago.

*1887. Sayre, Reginald H., M.D. Clinical Professor of Orthopedic Surgery in the University and Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of the Bellevue Hospital; Consulting Surgeon to the Hackensack (N. J.) Hospital; Consulting Surgeon to the Hospital for Sick Children, Newark, N. J. 9 East Forty-fifth Street, New York.

*1887. Schapps, John C., M.D. Pony, Mont.

*1887. Shaffer, Newton M., M.D. Surgeon-in-Chief to the New York State Hospital for the Care of Crippled and Deformed Children; Professor of Orthopedic Surgery, Cornell University Medical College; Consulting Orthopedic Surgeon to St. Luke's and Presbyterian Hospitals; Consulting Surgeon to the New York Infirmary for Women and Children. 28 East Thirty-eighth Street, New York.

1896. Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of Columbia University; Assistant Physician-in-Charge of General Diseases at Emergency Hospital and Central Dispensary; Surgeon-in-Charge of Orthopedic Department Emergency Hospital and Central Dispensary; Attending Physician to Newsboys' Home and Children's Aid Society. 1319 New York Avenue, Washington, D. C.

1889. Sherman, Harry M., A.M., M.D. Orthopedic Surgeon to the Children's Hospital, San Francisco; Clinical Professor of Orthopedic Surgery in the Medical Department of the University of California. 1303 Van Ness Avenue, San Francisco.

1902. Spellissy, Joseph M., M.D. Out-Patient Surgeon at the Pennsylvania Hospital; Assistant Surgeon at the Orthopedic Hospital and at the Orthopedic Department of the University Hospital; Visiting Surgeon at St. Joseph's and the Methodist Hospitals. 110 South Eighteenth Street, Philadelphia.

1900. Starr, Clarence L., M.D. Orthopedic Surgeon to Hospital for Sick Children; Registrar to Toronto General Hospital; Demonstrator of Clinical Surgery in Medical Faculty, University of Toronto. 95 Bloor Street, West, Toronto, Canada.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery in the Medical Department of Washington University; Orthopedic Surgeon to the Martha Parsons Children's Hospital and to the Missouri Baptist Sanitarium. 2825 Washington Avenue, St. Louis.

*1887. Taylor, Henry Ling, M.D. Professor of Orthopedic Surgery and Attending Surgeon to the New York Post-Graduate School and Hospital; Assistant Surgeon to the Hospital for the Ruptured and Crippled; Consulting Orthopedic Surgeon to the State Epileptic Colony, Sonyea, N. Y. 125 West Fifty-eighth Street, New York.

1897. Taylor, Robert Tunstall, B.A., M.D. Surgeon-in Charge of the Hospital for Crippled Children; Clinical Professor of Orthopedic Surgery, University of Maryland; Orthopedic Surgeon to the University Hospital in Baltimore. 2000 Maryland Avenue, Baltimore, Md.

1892. Taylor, William J., M.D. Attending Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women. 1825 Pine Street, Philadelphia.

1892. Thorndike, Augustus, M.D. Surgeon to Good Samaritan Hospital; Assistant Surgeon to West End Infant Hospital and Junior Assistant Surgeon to Children's Hospital. 601 Beacon Street, Boston.

1889. Townsend, W. R., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Visiting Surgeon to Randall's Island and Bayonne Hospitals; Consulting Orthopedic Surgeon to the French Hospital. 125 West Fifty-eighth Street, New York.

1901. Waterman, J. Hilton, M.D. Instructor in Orthopedic Surgery in the New York Polyclinic Medical School and Hospital; Clinical Assistant in the Hospital for the Relief of the Ruptured and Crippled. 50 West Fifty-first Street, New York.

1889. Weigel, Louis A., M.D. Professor of Orthopedic Surgery in the Medical Department of Niagara University, Buffalo; Orthopedic Surgeon to Rochester City Hospital and Out-patient Department; Consulting Orthopedic Surgeon to Provident Dispensary. 209 East Avenue, Rochester, N. Y.

1890. Whitman, Royal, M.D. Instructor in Orthopedic Surgery and Chief of the Orthopedic Division of the Vanderbilt Clinic in the College of Physicians and Surgeons; Adjunct Professor of Orthopedic Surgery in the New York Polyclinic; Associate Surgeon to the Hospital for Ruptured and Crippled, New York. 283 Lexington Avenue, New York.

*1887. Willard, De Forest, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. 1818 Chestnut Street, Philadelphia.

1891. Wilson, H. Augustus, M.D. Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Orthopedic Surgeon to the Kensington Hospital for Women and to the Philadelphia Lying-in Charity. 1611 Spruce Street, Philadelphia.

1890. Young, James K., M.D. Professor of Orthopedic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College; Assistant Orthopedic Surgeon to the Hospital, University of Pennsylvania; Instructor in Orthopedics in University of Pennsylvania; Surgeon to the Home for Crippled Children; Orthopedic Surgeon, Hospital of the Good Shepherd, Radnor. 222 South Sixteenth Street, Philadelphia.

DECEASED.

ACTIVE MEMBERS.

Elected

1887. Buckminster Brown, M.D.
1887. Edward Develin, M.D.
1892. A. E. Hoadley, M.D.
1887. Harry Hodgen, M.D.
1887. Samuel Ketch, M.D.
1887. George W. Ryan, M.D.
1887. Lewis Hall Sayre, M.D.

HONORARY MEMBERS.

1895. William Adams, F.R.C.S. February 3, 1900.
1889. Henry G. Davis, M.D.
1892. William Detmold, M.D.
1889. William J. Little, M.D., F.R.C.P. Lond., M.R.C.S. Eng.
1893. Leopold Ollier, M.D.
1889. David Prince, M.D.
1889. Lewis A. Sayre, M.D.
1891. C. Fayette Taylor, M.D.

CORRESPONDING MEMBERS.

1889. F. Beely, M.D. April 30, 1902.
1894. Bernard E. Brodhurst, F.R.C.S. Eng.
1892. Nicholas Grattan, F.R.C.S. Edin.
1890. Hugh Owen Thomas, M.R.C.S. Eng.

HONORARY MEMBERS.

ELECTED

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1893. O. LANNELONGUE, Professeur à la Faculté de Médecine de Paris (Chaire de Chirurgie); Membre de l'Académie de Médecine; Chirurgien de l'Hôpital Trousseau â Paris, et Député au Parlement Français, et Président de l'Association Générale de Médecine de France. 3 Rue François I., Paris.

1897. BENJAMIN LEE, M.D., Secretary of the State Board of Health of Pennsylvania. Crozer Building, 1420 Chestnut St., Philadelphia, Pa.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1900. JAMES E. MOORE, M.D., Professor of Clinical Surgery and Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children; 802 Dayton Building, Minneapolis, Minn.

CORRESPONDING MEMBERS.

ELECTED

1892. Dr. M. BILHAUT, Rédactuer en Chef des Annales d'Orthopédie et de Chirurgie pratiques; Chirurgien des enfants de l'Hôpital International. 5 Avenue de l'Opera, Paris, France.

1894. Dr. JULIUS DOLLINGER, ausserordentlich-öffentlicher Professor für Orthopädie an den königl. ungarischen Universität in Buda-Pest, Operateur und dirigirenden Oberarzt der chir. Abtheilung im Spitalls der Barmherzigen Brüder in Buda-Pest; Mitglied des Landessanitätsrathes; Mitglied des Landesunterrichtsrathes; Mitglied mehrer wissenschaftlichen Gesellschaften und Vereine. Buda-Pest (Ungarn), Rerepescher Str. 52.

1890. Dr. A. HOFFA, Professor der Chirurgie an der Universität Würzburg; Correspondirendes Mitglied der Société de Pediatrie de Paris. Sieboldstrasse 10, Würzburg.

1890. ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital. 11 Nelson Street, Great George Square, Liverpool, England.

1899. C. B. KEETLEY, F.R.C.S. Eng., Senior Surgeon to the West London Hospital; Hon. Treasurer British Orthopedic Society. 56 Grosvenor Street, W., London, Eng.

1890. Dr. E. KIRMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants Assisté. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIGFRIED LEVY, Superintending Surgeon of the Society for the Relief of Crippled and Mutilated Children, Copenhagen. 135 Gothersgade, Copenhagen, Denmark.

1892. ERNEST MUIRHEAD LITTLE, F.R.C.S. Eng., Surgeon to the National Orthopedic Hospital. 40 Seymour Street, Portman Square, London, England.

ELECTED

1889. Dr. ADOLF LORENZ. IX. Garnisongasse 3 (Garellihoff), Vienna, Austria.

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to and Joint Lecturer on Surgery at St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istitutio dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon, German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL RÉDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng., Orthopedic Surgeon to the Royal Alexandra Children's Hospital, Brighton. 38 Harley Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., M.D., Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. Senior Surgeon to the City Orthopedic Hospital. 24 Queen Anne Street, Cavendish Square, W., London, England.

1899. ALFRED H. TUBBY, M.S., M.B. Lond., F.R.C.S. Eng., Surgeon to the Westminster, National Orthopedic and Evelina Hospitals. 25 Weymouth St., Portland Place, W., London, England.

1899. OSCAR VULPIUS, Privatdozent der Chirurgie au der Universitat Heidelberg, Dozent für Orthopädische Chirurgie Dirigirender Arzt der Orthopädische Chirurgischen Heilaustalt in Heidelberg, Luisenstrasse No. 1.

ELECTED

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen, Joint Surgeon and Lecturer on Surgery at St. Bartholomew's Hospital; Surgeon to Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Bromley Cottage Hospital. 77 Harley Street, London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon., F.R.C.S., Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

THIS Society shall be called the "AMERICAN ORTHOPEDIC ASSOCIATION."

ARTICLE II.—OBJECT.

The purpose of this Association shall be the advancement of orthopedic science and art.

ARTICLE III.—MEMBERSHIP.

SECTION 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

SEC. 2. There shall be three classes of members, viz.: Acting, Corresponding, and Honorary.

SEC. 3. The number of Active Members shall be limited to sixty, and of Corresponding Members to thirty.

SEC. 4. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three members, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars.

ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs at the close of the regular meeting.

ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

ARTICLE XI.—THE CONGRESS.

SECTION 1. This Association shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the first annual meeting held after the adjournment of any Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all the members present; provided that notice

of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

BY-LAWS.

ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for membership, and shall be placed in the hands of the Secretary at the previous meeting to the time of the regular meeting. The names of the candidates for membership, together with a statement of their official positions, and the names of their proposers and seconders shall be sent by the Secretary to each Active Member of the Association at least one month before the time of the annual meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged pre-eminence in orthopedic surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 5. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint a Committee on Membership of five, two of whom shall have served the preceding year, and a Committee on Publication, and shall fill any vacancies that may occur from resignation or otherwise. The names of the members of the committees thus appointed by the President shall be printed in the annual minutes.

SEC. 3. The Vice-President shall act in the absence of the President.

SEC. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, shall send all papers pertaining to candidates for membership to the chairman of the Committee on Membership one month previous to the time of the annual meeting, including their theses, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

SEC. 5. The Treasurer shall collect all moneys due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

SEC. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

SEC. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work, and report the same to all members as early as practicable before the time of the annual meeting. It shall further manage such necessary affairs of the Association as are not already assigned to others.

SEC. 8. The Publication Committee, of which the retiring President shall be one, shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and shall have discretionary power as to the matter for publication in questionable cases. The Publication Committee shall have printed in the annual volume of TRANSACTIONS an index of orthopedic literature of the preceding year, arranged alphabetically, both by authors and titles.

ARTICLE III.—ELECTIONS.

The election of officers and members shall be held at the last executive session of the regular meeting.

ARTICLE IV.—MEETINGS.

SECTION 1. The regular meetings shall be held annually during the third week in May of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

SEC. 2. Special meetings may be called by the Executive Committee or by the President at the written request of ten active members.

SEC. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

ARTICLE VI.—PUBLISHED PROCEEDINGS.

SECTION 1. The TRANSACTIONS shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each, except to those in arrears on Association dues.

SEC. 2. Additional copies of the TRANSACTIONS shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

SEC. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

SEC. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the TRANSACTIONS on the unanimous vote of the Publication Committee.

ARTICLE VII.—PAPERS AND DISCUSSIONS.

SECTION 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the floor. The author of the paper shall be privileged to close the debate.

SEC. 2. No papers shall be read that have been previously published. Members publishing their papers after they have been presented to the Association shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary wood-cuts.

SEC. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's corrections. Marked changes from copy, known as "time-work," shall be paid for by the author.

SEC. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for rewriting.

ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting—to wit: at noon of the first day and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.
4. Election.
5. New business.

The last act before the adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

ARTICLE IX.—AMENDMENTS.

All proposed amendments to the By-laws shall be submitted in writing, signed by two active members, at a previous annual meeting. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

THE PRESIDENT'S ADDRESS.

THE ADVANCE OF ORTHOPEDIC SURGERY.

By H. AUGUSTUS WILSON, M.D.,
PHILADELPHIA.

The Philadelphia members extend a cordial greeting to the American Orthopedic Association upon the occasion of the fifteenth anniversary, meeting for the second time in this city. It is a coincidence that at this fifteenth anniversary there are fifteen of the thirty-five original Fellows still active. Nine are deceased. Some of the others, through lack of special interest in orthopedic surgery, have entirely withdrawn from the Association, some rarely attend or participate, some to give more attention to general surgery, and others to general practice of medicine. While a number have fallen by the wayside, new and energetic Fellows have, from time to time, been added, until now the full number of sixty, prescribed by the By-laws, has been almost attained, and the Association is confronted with a waiting list of desirable candidates.

One of two courses appears to be necessary if the present limit to membership of sixty continues. Either recourse must be had to By-laws, Art. I., Sec. 6, which says, "Membership shall be forfeited when one ceases to take an active interest in the objects of the Association," or else the limit to membership must be removed. The removal of the limit to membership would appear to be free from serious danger, for with proper safeguards of careful individual scrutiny in advance of the annual meeting, analysis by the Committee on Membership, and, finally, election by a four-fifths majority at an executive

session, it would seem as though only suitable men could be admitted. This Association needs the interest of every physician "in good professional standing" who is "especially interested in orthopedic surgery." Every teacher of orthopedic surgery requires the benefits to be obtained only by Fellowship in this Association. Thus hand-in-hand the best objects of the Association can be secured; the stronger and more powerful the Association, the better and more forceful will the Fellows become. Each will receive the beneficial influences that have so characterized the growth of our Association, an organization based on harmony, and having the single object of advancing the best interests of orthopedic surgery and all that pertains thereto.

The Association has prospered even beyond the most sanguine expectations of its founders. Its influence is appreciated throughout the world. The methods of fifteen years ago have very materially changed as a result of the work of the Association in fostering careful study of etiology, pathology, and collective study of results of procedures. The improved work of individual members has only been a part of the benefit that has been obtained by this organization. By precept and by example, by didactic and clinical undergraduate and post-graduate teaching, by addresses before medical societies, by medical journal literature, by monographs and text-books, the errors of the past are becoming less common, and patients throughout the world are receiving direct benefit. Many of the serious deformities of the past are now unknown. Many conditions previously considered as incurable are now being arrested in the beginning, before destructive changes have taken place.

It is evident that the force of the Association lies in uniting the individual strength and power of its Fellows as practitioners, as teachers, and as writers. In the President's address, 1899, Sherman dwelt upon the teaching force of our Fellows, and showed that from five medical colleges which in 1887 included orthopedic surgery in their courses the number has steadily increased until now practically all medical colleges provide instruction thereon. In many the dignified and suitable title of Professor is given, in a lesser number Clinical Professor, and

in very few Associate or Assistant Professor. The instruction is provided by didactic and clinical lectures, demonstrations, laboratory and ward classes, to the end that every student upon graduating should be made an efficient general practitioner and be given a working or necessary knowledge of the subject in addition to the thorough grounding in the other essentials of medicine and surgery.

Various State boards of medical examiners have, from time to time, very properly included in the surgical examinations questions upon orthopedic surgery subjects, thereby indicating the necessity of at least an elementary knowledge of these subjects. This action on the part of the licensing bodies does not make, nor tend to make, specialists of the graduating student, as some would have us believe, but indicates the urgent necessity for general practitioners being properly prepared to recognize and treat those diseases of the spine and other joints, the failure to do which entails progress of the destructive changes and ultimate permanent loss of function and death. This action of the State boards of medical examiners should, it is believed, be commended and encouraged within proper limits.

In the President's address of 1898 Townsend directed attention to the practical side of the subject by dwelling upon the hospitals devoted entirely to orthopedic patients, and showed great increase in the number of these hospitals during the past fifteen years, until now there is at least one such institution in every large community, while in the large general hospitals special departments of orthopedic surgery have been established. Following the plans of Gillette, Bradford, and others, educational institutions have been established that have for their objects the mental and manual development during the long time that orthopedic procedures are in operation.

It is appropriate that at this time and in connection with the foregoing consideration of the advance of orthopedic surgery the subject of its literature should be briefly alluded to, for it is one of the legs of the tripod consisting of teaching, practice, and writing. To this end every Fellow has been urged to send a complete list of his orthopedic and other writings that have been published during the past fifeen years. The list is far

from complete, as some Fellows have failed to reply; but an aggregate of 1951 titles has been received, a number far in excess of the total number appearing in the fourteen volumes of our TRANSACTIONS (518).

The writings of the individual Fellows are tabulated as follows:

Diseases of the hip	188
Diseases of the spine	226
Lateral curvature of the spine	142
Fracture of the spine	8
Congenital dislocation of the hip	67
Wryneck	22
Paralytic deformities	78
Diseases of the knee	86
Bowlegs and knock-knee	30
Club-feet	189
Other conditions of the feet	44
Shoes and feet	9
Tendons	11
Spina bifida	19
Coxa vara	11
Diseases of the bones and joints not included in above	256
Miscellaneous	565
	1951

In marked contrast to this vast array of work by our own Fellows, it is of interest to find that the complete list of orthopedic literature published between the years 1825 and 1860 numbers only 172, according to Bradford's Presidential address of 1889. Seven text-books devoted to orthopedic surgery, and published during the past fifteen years, more clearly than anything else demonstrate the importance of the subject. These text-books are to be found in the lists of text-books in every medical college. Two journal periodicals edited by Corresponding Fellows would appear to indicate the possible future of our TRANSACTIONS.

Our TRANSACTIONS is a storehouse of limited list of papers, limited to those read before the Association and accepted by the Publication Committee—a very small part of the orthopedic literature of our own Fellows, to say nothing of the many valuable writings of those other than Fellows.

The annual volume of TRANSACTIONS is at times quoted by American and foreign writers; but far more frequently reference

is made to the original publication in one of the medical journals. If our TRANSACTIONS is to be a storehouse, it is believed that it should be such in fact as well as in name, and this can be accomplished in several ways, some of which have been considered in the past, and one is now suggested. This plan, possibly previously discussed, is to transform our TRANSACTIONS into a year book of orthopedic surgery; to include in its pages not only the best papers that are read at the meetings and the discussion thereon, but also all papers of decided merit, and especially to include comprehensive abstracts of all orthopedic literature, no matter where published or in what language. Titles give no conception of the contents of papers, and are frequently misleading, while good abstracts, preferably prepared by the authors, would provide accurate knowledge of the scope and purport of the papers. If authors failed to furnish abstracts of their papers, satisfactory abstracts could very frequently be obtained from medical journals, which are in the habit of regularly furnishing such information to their readers, and thus very few papers would require attention from our own Editorial Committee.

The complete bibliography of the years 1899 and 1900, numbering 583 titles, that was furnished by the Boston Fellows, and printed in the thirteenth volume of our TRANSACTIONS for 1900, confirms the recognition of the fact that very many valuable papers upon orthopedic subjects are written by others than Fellows of this Association, papers that are quoted as integral parts of collective investigations and bibliographies. With a corps of editors and collaborators such as this Association could efficiently provide, with a suitable publisher, it would appear possible to secure a large subscription list among those who are not members nor likely ever to become such, and yet who are more or less interested in some parts of orthopedic surgery. Orthopedic surgery, rather more than any other special branch of the general subject of medicine, extends into every field in its preventive and corrective measures. The chronicity of many of the bone and joint lesions, and the necessity for prolonged orthopedic treatment, often demands the conjoint services of the general family practitioner, whose skill may be demanded

for the usual maladies during the period of orthopedic treatment. General practitioners and general surgeons may very properly be expected to add an orthopedic year-book to their libraries.

The adoption of the suggested plan of publishing the TRANSACTIONS would not necessarily change the present method pursued by nearly all Fellows of publishing their papers in general medical journals shortly after they have been read at our annual meetings and often months before they are said to be buried in the TRANSACTIONS.

The efficient work of the standing committees deserves special commendation for the zeal manifested and for the results accomplished. The Publication Committee is still hampered by the delay in obtaining the manuscripts, a delay that should be discouraged and avoided, to which end extracts from the By-laws have been given a conspicuous position upon page 3 of the programme.

The serious responsibilities resting upon the Committee on Membership have been well met; but it can only present a thoroughly satisfactory report by having all propositions for membership in hand before the time for the annual meeting. The heretofore necessarily hurried consideration of the standing, ability, and general desirability of candidates at a committee meeting held during the session of the Association is inadequate, and can be avoided in future by the use of the new form of blanks for proposing new members. Sending the entire list of candidates for membership to every Fellow one month in advance of the annual meeting should enable the committee to obtain definite information upon which to base its report.

It is my province at this time to chronicle the death, on April 30, 1902, of Dr. Florian Beely, of Berlin, Germany, in his fifty-seventh year. Dr. Beely was elected a Corresponding Fellow in 1889, and was in attendance at our fifth session, held in Washington, in September, 1891, when he read a paper entitled "A Contribution to the Pathological Anatomy of Scoliosis." He also took an active part in the discussion of other papers, and those who were present at that session will recall the careful studious manner in which he spoke, which was due to his innate

modesty. His English, while having an accent, possessed beauty of thought and expression, his manner that of a thoughtful student. At the seventh session, held in St. Louis, in September, 1893, he contributed a paper entitled "Treatment of Slight Cases of Knock-knee," but was not present.

THE GENERAL MANAGEMENT AND CONSTITUTIONAL TREATMENT OF TUBERCULOSIS OF BONES AND JOINTS—SPECIAL REFERENCE TO THE USE OF TENTS.

By H. P. H. GALLOWAY, M.D.,
TORONTO.

In the treatment of tuberculous disease of bones and joints all surgeons recognize the value of functional rest, and in all standard text-books on surgery the various means of securing this by fixation, traction, local protection, etc., are more or less fully discussed; presumably careful and competent surgeons are also not neglectful of the general management and constitutional treatment of this class of cases. A somewhat careful examination of the literature of the subject, however, has caused the writer to feel that most authors make too little effort to impress upon their readers the fact that suitable environment and those general measures which are known to be of such great value in phthisis are also urgently called for when tuberculosis has attacked the bones or joints. The fourteen volumes of the Transactions of the American Orthopedic Association thus far published are replete with papers on almost every possible phase of tuberculous bone and joint disease, yet not a single paper devoted entirely to a consideration of the general management and constitutional treatment has appeared heretofore. In Volume V. there is a paper by Dr. J. D. Griffith on the use of guaiacol as a constitutional remedy; in Volume XI. the favorable effect of the climate of Colorado is dealt with by Dr. Geo. B. Packard; there are scattered incidental references to the value of fresh air, sunlight, etc., but in most of the papers and discussions the general management and constitutional treatment either are not mentioned or receive but a passing notice of at

most a few lines. Several excellent books on orthopedic surgery have emanated from members of this Association, but in none of these, in the writer's opinion, do the chapters on tuberculous bone and joint disease deal in a sufficiently emphatic and detailed manner with the general care of the patient. In the latest edition of Bradford and Lovett's *Orthopedic Surgery* (1899), over one-third of the book is devoted to a consideration of tuberculous disease of bones and joints, but beyond a couple of sentences on page 44 and a single sentence on page 295, no reference is made to general management and constitutional treatment.. Again, in Whitman's *Orthopedic Surgery* (1901) a similar proportion of the book is occupied by a discussion of the manifestations of tuberculosis that are of interest to the orthopedic surgeon, and although there are two pointed sentences on the importance of constitutional measures, one on page 58 and another on page 101, as well as incidental references in several other places, it seems to the writer that the matter receives much less attention to detail than its importance demands. In fact, of nearly all books on orthopedic surgery, as well as most standard works on general surgery, the criticism is not unfair, that so much attention is given to the details of local, mechanical, and operative treatment, while so much is taken for granted in regard to general management, that the reader can hardly fail to receive the impression that the latter is relatively unimportant. Of the volumes which the writer has examined, the one which appears to present most adequately the importance of looking after the patient as well as his joint is that by Nicholas Senn (*Tuberculosis of Bones and Joints*, 1892).

The neglect of most authors to lay greater emphasis upon the general management of patients with bone and joint tuberculosis is, it seems to me, largely responsible for the opinion held by so many general practitioners that the treatment of a case of chronic joint disease is practically summed up in the application of a suitable splint or brace. Every orthopedic specialist whose practice is largely of the referred and consultation variety needs only to look over his correspondence files and recall his consultations with general practitioners to be convinced that

the one prominent question asked by the practitioner who is seeking counsel in the management of a chronic joint case is, "What kind of a splint should be used?" as if the application of some appliance constituted the Alpha and the Omega of treatment in such cases. The reason why this subject has not received more liberal attention in surgical literature is perhaps not difficult to discover. It is only a comparatively short time since the immense usefulness of mechanical apparatus in the treatment of chronic joint disease has come to be universally recognized, and our observation of the enormous superiority of the results achieved by mechanical methods over the measures formerly employed has caused us to direct all our energies to the perfecting of means for securing thorough rest and protection, with the result that the mechanical problems in connection with the joint have absorbed too large a share of our attention, and we have forgotten at times that the joint is but part of a patient. Moreover, it is but a short time since we began to realize that fresh air, sunshine, and proper food and clothing are more important than all other measures combined in the prevention and cure of pulmonary tuberculosis, while judging by our writings, and possibly to a considerable extent by our practice also, we are still largely unconscious of the fact that proper environment and the measures for general invigoration and increase of resisting power, which experience has shown to be so useful when tuberculosis has attacked the lungs, are also urgently called for if we expect the best obtainable results when this disease is located in other tissues. I do not for a moment presume that the members of this Association are doubtful of the benefit to be derived from good general management and constitutional treatment in tuberculous joint cases, but I question whether our theoretical views are always consistently embodied in our practice, and this paper is presented for discussion in the hope of arousing renewed attention to the subject, together with a desire to do something toward filling in what appears to me an undesirable gap in our recorded Transactions, rather than with the expectation of offering anything very new.

In the general treatment of bone and joint tuberculosis drugs

occupy a small and relatively unimportant place. Tonics, such as iron and arsenic, in small doses, are sometimes of service, but most cases are as well without them if proper hygienic conditions can be secured. Cod-liver oil, during the winter months, if it be well digested, is often distinctly beneficial, especially to children, but good, sweet cream is perhaps even more useful. Milk, cream, and butter of the best quality should enter largely into the dietary, along with such staples as oatmeal porridge, whole wheat bread, and beef. In general, the diet should be simple and nutritious, and it is especially necessary to intelligently adapt the patient's food supply to his digestive power and eliminative capacity. The wisdom of blindly encouraging every tuberculous patient to swallow large quantities of highly nutritious foods without carefully considering his ability to assimilate them may well be doubted. Every agency should be employed which will fortify the patient's constitution, augment his general vigor and increase the resisting power of his tissues, and it may be claimed that of all the various means to these important ends at our command the most valuable are fresh air and sunshine. The more nearly the patient can be brought to a continuous out-door life, with the inconveniences of such a mode of living eliminated, the better. The best means of securing this will depend upon circumstances. The ideal method is to place the patient in practically the same kind of environment as is found in the best sanatoria for pulmonary tuberculosis. In fact, sanatorium methods are almost as indispensable to the best results in bone and joint tuberculosis as in phthisis. Saying this is equivalent to claiming that the vast majority of poor patients cannot properly be treated in their own homes, and that even in the homes of the well-to-do special arrangements are necessary, and such is the case. The poor should be treated, at least for a time, in hospitals, not in ordinary hospital wards, but in hospitals with special provision for the requirements of tuberculous patients in regard to sunshine and fresh air. I know of few more discouraging problems than the attempt to treat successfully, and guard against relapse, the immense number of tuberculous joint cases seen in the orthopedic clinics of the hospitals in large cities. The depression of vital powers which

results from insufficient and unsuitable food is accentuated by breathing the vitiated atmosphere of small, close, dirty rooms, and is multiplied almost indefinitely by the general ignorance, wretchedness, poverty, vice, and bad heredity of the submerged classes in our large centres of population. The only hope of giving such patients a fair chance in the conflict with such a foe as tuberculosis consists in securing for them, for a time at least, proper hygienic surroundings, and this for the purpose of enlightening them as to their own requirements not less than for the immediate beneficial effect of the improved environment. The writer is not blind to the practical difficulties in the way of providing suitable hospital accommodation during lengthened periods for the multitude of patients with chronic tubercular joint affections; nevertheless, it is the duty of the medical profession to arouse attention to the existing need and to point out that civilization and philanthropy have thus far failed adequately to provide for it. The requirements will not have been met until the poor who suffer from these affections can command the advantages of sanatorium methods, at least during the acute stage of the disease and in the winter season. In the convalescent period and during summer they can be treated fairly well as out-patients, for a great many cases, even among the poor, do reasonably well in the warm season when for their own comfort they are compelled to open up their houses, live out-of-doors to some extent, and get all the fresh air possible. My observations have convinced me, however, that relapse and aggravation of Pott's disease, hip-joint disease and other chronic tuberculous joint troubles are especially apt to occur during the latter part of the winter, the reason being that the patient's general health and resisting power have been greatly reduced by months of residence in close, ill-ventilated rooms. In the case of the very poor the only sure way of preventing this deterioration of general health and its resulting unfavorable influence upon the joint affection is to provide for them a suitable environment during the inclement season.

The plan of treating pulmonary tuberculosis in tents is one which has gained greatly in favor during the past few years, as it has proved a simple, practical, inexpensive, and efficient

method of enabling patients to live all the time practically in the open air. The ventilation in a tent may be made nearly perfect; for although special, controllable, ventilating openings should be arranged, one has but to examine a piece of canvas under a microscope to be convinced that an immense volume of air must diffuse itself through the natural open windows of this fabric, especially during cold weather, when the tent is heated and a difference in temperature between the inside and outside air thus created. That such rapid diffusion actually takes place is proved by the freedom from foulness of the atmosphere in the tent even when patients are crowded together in a way that could not safely be permitted in an ordinary hospital ward, and by the relatively large amount of fuel required to heat the tents. This fact, that the colder the weather the better is the ventilation, makes the tent especially valuable during winter, when the patients are more inclined to shut themselves up. During summer, of course, the sides of the tent are raised and the patients are then practically in the open.

Over a year ago some experiments in treating in tents patients suffering from tuberculous bone and joint disease were begun in the Toronto Orthopedic Hospital. In fourteen months (March 15, 1901, to May 15, 1902) there were admitted to the tents the following cases: Pott's disease, 25; hip-joint disease, 13; white swelling of knee, 6; white swelling of ankle, 4; white swelling of elbow, 1; in all 49 different cases. The shortest period spent in the tent by any patient was 1 day, the longest 343 days.

The entire number treated has been too small, and the period over which the observations extended too short to permit of any exact scientific deductions; moreover, the method of keeping records has hardly been sufficiently uniform and exact to make any compilation of statistics possible. Consequently the writer's object is simply to record a few general observations. In a general way, then, it may be stated that from observing these cases and contrasting their behavior after they entered the tents with their previous progress under ordinary conditions, the conclusion arrived at has been emphatically and even enthusiastically favorable to tent life. The response to the change is usually immediate and pronounced. In most cases a dis-

tinct improvement in appetite is observed within twenty-four hours; both nurses and kitchen staff report that relatively a larger proportion of food is consumed, and it is eaten with greater relish by the tent patients than by those in other wards. I have repeatedly been struck by a distinctly favorable change in the color and expression of the face within one or two days after admission to the tents, the dull, listless, sickly, anæmic appearance having within that brief time undergone a change which could not fail to attract attention. The patients almost immediately begin to put on flesh, while mental depression vanishes, and a buoyant, happy, hopeful feeling takes its place. The general impression left upon the surgeon's mind as he observes the patients day after day is that they are doing well, that their general health is being rapidly improved, their physical capital augmented and their resisting power reinforced. Improvement in the local conditions is usually quite as satisfactory, but is slower in manifesting itself, and appears to be consequential upon the improved general condition. The conclusion is irresistible that most of the patients have made much more rapid strides toward recovery than would have been possible under ordinary conditions. It is interesting to note that the friends of patients under treatment in the tents are usually greatly delighted with the improvement they observe, and in some instances parents are very anxious to secure the readmission of children whom they had removed. Another fact worthy of being referred to is that the general health of the nurses who are on duty in the tents undergoes a distinctly favorable change. They report increase of appetite, and that they feel stronger and more vigorous, and it is quite certain that their gain in flesh and improvement in color could hardly fail to attract the attention of even a careless observer. So conscious are the nurses of the difference that they invariably regret when their turn comes to return to duty in the regular wards.

While out-door life is of great assistance in the treatment of all tuberculous bone and joint affections, it is particularly useful in that class of patients whose recuperative power appears to have been exhausted, and who are being slowly worn out by discharging sinuses which other means of treatment have failed

to heal. We are all only too familiar with these unpleasant cases, in behalf of which we have put forth our best efforts, but in which surgical and mechanical methods alike have failed or been but partially successful, and in which the tuberculous process creeps on from one portion of tissue to another, or has become so deep-seated in the pelvis or spine that it is practically beyond reach of direct treatment. In some such cases our only resource lies in efforts to improve the general resisting power of the patient; if this can be done he has a chance of escaping from the malady which holds him so relentlessly. It is not an exaggeration to claim that the lives of some such patients may be saved through the agency of fresh air and sunshine after all other means have failed. It is not claimed that tents offer the best solution of the problem of securing the nearest approach to a continuous out-door life, but that properly designed tents suitably located are much better than the average hospital ward, and that they are an efficient and inexpensive supplement to the regular wards. The kind of buildings and much of the routine of life adopted in modern sanatoria for pulmonary tuberculosis are probably just as useful and efficient as tent life, and are certainly more convenient, and such buildings and a similar routine should be employed by all hospitals which aim at affording everything necessary for the best care of patients with surgical tuberculosis. In the case of private patients, various expedients may be resorted to to secure the benefit of sunshine and fresh air, when for any reason residence in a sanatorium is impracticable or undesirable. Many patients who have a lawn in connection with their homes can be induced to fit up a private tent and occupy it even during the winter months. Others who have a veranda with a southern exposure can be taught to make good use of it, and soon learn to enjoy spending much of the time in the open air even in cold weather, their body clothing and bed covering being, of course, adapted to the season. Even in ordinary private houses the ventilating arrangements of living and sleeping rooms often can be enormously improved by the exercise of a little ingenuity, and the surgeon should give these arrangements personal supervision.

No reference thus far has been made in this paper to the neces-

sity of using such special orthopedic treatment as each case may call for. It is admitted by all that a certain proportion of tuberculous bone and joint cases will ultimately terminate favorably as far as arrest of the morbid local process is concerned, under purely expectant measures. We all know, however, that this spontaneous recovery is usually accompanied by unnecessary and often pitiable deformity, and we are quite as certain that not only can deformity be largely prevented, but that the disease can be brought to a termination in a shorter time, with less destruction of tissue, and at the expense of far less suffering, by the intelligent use of surgical and mechanical means. It is important not to misunderstand the true relation of constitutional measures to surgical and mechanical treatment. The mistake is often made of supposing that a patient is necessarily deprived of the benefit of exercise and fresh air while confined to bed. Many orthopedic cases are best managed throughout the acute stage in the recumbent position, fixation dressings, extension, etc., being used according to indications; but it is most important to see that this period of enforced inactivity is passed in a suitable environment, and that the lack of active exercise is compensated for as largely as possible by systematic, efficient massage. On the other hand, it is necessary to guard carefully against the error of looking upon fresh air and sunshine as substitutes for surgical and mechanical means. Their true office is complemental, not vicarious. Our efforts to perfect mechanical and local methods of treatment must not be relaxed, but we should strive more earnestly to secure such fortification of the patient against relapse or other manifestations of vulnerability as are afforded by hygienic living and improved environment.

When we recall the deplorably large number of relapses after apparent cure, and the great proportion of our cured patients who afterward die of some other form of tuberculosis, it becomes a practical and serious question whether we are not largely responsible for these unfortunate sequels by our failure to make greater efforts to regulate permanently the habits and environment of our patients.

In conclusion, let me say that when an individual with tubercu-

lous disease of hip, spine, knee, ankle, etc., presents himself for advice, *the surgeon's first duty is to realize that he is being consulted by a patient who has tuberculosis;* and just in proportion to the clearness with which this idea is defined in his own mind will the surgeon be able to take a comprehensive grasp of the present and future needs of his patient. Painstaking efforts to teach the patient, or in the case of a child, those responsible for him, as much as they are capable of understanding about the nature of this disease will be well rewarded. The patient's hearty co-operation, which is so indispensable, is likely to be secured only in proportion as the surgeon succeeds in making him grasp what tuberculosis means and what its existence in his system implies.

ELEVATED SCAPULA—TWO CASES.

By A. J. STEELE, M.D.,
ST. LOUIS.

A few months since I read in the London *Polyclinic*, September issue, 1901, vol. v., No. 3, p. 126, the report of a clinical lecture by Jonathan Hutchinson on "Sprengel's Shoulder." He exhibited a girl, aged ten years, with elevation of the right scapula, and remarked that, so far as he knew, it was the first typical example recognized in England of the malformation to which Sprengel, in 1891, had called attention. Thus it occurred to me that if this deformity was so exceedingly rare in England it might be worth while to put on record two additional cases that have fallen under my own observation.

Case I.—B. M., female, now aged fourteen years, with right scapula elevated and so rotated that the lower angle is carried inward and slightly overrides the spine, pointing to about the middle of the opposite scapula. The entire bone is smaller than its fellow, and the upper angle is prominent at the base of the neck. It is slightly movable by pressure with the fingers, but glides on the ribs as the arm is carried upward or backward. The corresponding clavicle is one inch shorter than its fellow of the opposite side. The right ear is markedly smaller than the left, and the lobe is bifid. There also exists a slight lateral curvature of the spine to the right. The girl has good use of the extremity, except in elevation of the arm.

I have reason to believe that this condition existed from birth, though the mother says that when a very young child a person injured the shoulder by pulling suddenly on it, and that it went back with a snap, and the deformed shoulder was first observed at that time.

I first saw this case nine years ago, at which time certain

peculiarities were less marked than at present. The rotation of the scapula was not so great, the lower angle being an inch or more from the spine, and lateral curvature did not exist. The photograph taken at that time was not distinct, and has become misplaced. The photographs I now exhibit are recent.[1]

FIG. 1.

No treatment has been employed in this case, except that recently gymnastic exercises have seemingly lessened the deformity and increased the mobility.

CASE II.—K. T., male, aged eleven years, was first seen by me eight years ago. I have been unable recently, on account of the physical condition of the boy—temporary illness—to obtain a photograph of his back. Those I exhibit were taken in 1894. They show a typical case of Sprengel's shoulder: the elevated and atrophied left scapula, the bony prominence of the upper angle—to be observed even from in front—the high shoulder, and the shortened clavicle. The scapula cannot be moved downward, but can be rotated. The deformity has existed since birth.

A note made by the late Dr. Henry Mudd, who examined

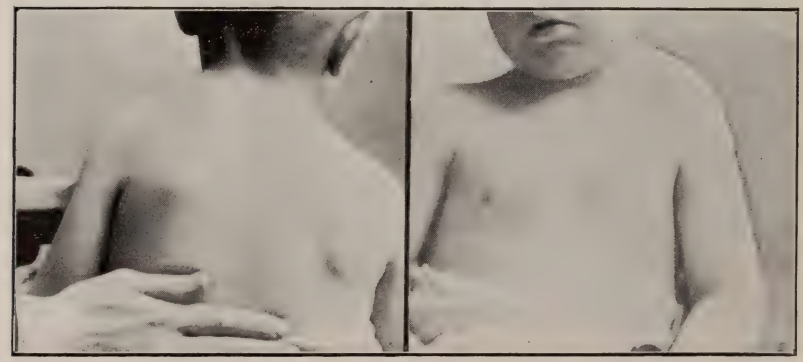
[1] Our radiographs, unfortunately, were not sufficiently distinct to exhibit.

the case in 1894, reads: "The left shoulder-blade is rotated so that the upper angle is in the neck. Base of spine of scapula pulled up to seventh cervical spine, and the inferior angle nearer the spinal column than natural, and up to the fourth rib. Thickened about the posterior border from the superior angle to the base of spine, and firmly held to the seventh cervical vertebra by ligaments. The bone moves or rotates about this point."

Dr. Mudd at the time proposed to divide this ligamentous union, and thus free the scapula, but the parents refused their consent.

No treatment has ever been adopted, except the futile manipulations of osteopathy, for many months, by the father.

Fig. 2.



While at present the deformity is marked, yet the lad is active in his sports and takes his place with his companions in all their games.

Four other cases of this shoulder deformity have already been reported to our Association: two by Goldthwait and Painter, one by Gibney, and one by Freiberg. More recently Spellissy, one of our proposed members, has reported two cases to the Academy of Surgery, of this (Philadelphia) city.

So that, take it all in all, the affection is not as rare as the remark of Mr. Hutchinson would have led us to suppose.

Sprengel, of Dresden, in 1891, described four cases,[1] so this

[1] Langenbeck's Archiv, vol. xlii. p. 545.

condition has taken his name. The usual rotation of the scapula, in which the lower angle is carried inward and upward, would seem to confirm the opinion of Sprengel, that this deformity is caused by the arm being fixed and held constantly behind the back in intra-uterine life; but that would not account for the complications so often present.

Quite recently Kausch, of Breslau, has reported (Mikulicz Clinic) five cases of this condition in which he attributes the cause to absence, in whole or in part, of the trapezius. In three cases the lesion was unilateral, and in them the lower segment of the muscle was wanting. In two cases the deformity was bilateral, in one of which both the lower segments of the muscle were absent, and in the other the muscle was entirely lacking on one side, and on the opposite side small bands of the middle and lower portions were wanting. In all the cases the remaining musculature was normal. The scapula was atrophied and deformed in two cases, and the superior angle often found bent forward. Out of 30 reported cases he found 8 cases with exostosis, and all with scoliosis. Therapeutically, he advised massage, electricity, and jackets. His surgical interference had been a failure.

In summing up this whole matter, it appears we are quite at sea as regards the etiology of this affection and that our therapeutics are not constant.

DISCUSSION.

Dr. N. M. Shaffer said that in 1886 he had seen a patient with an elevated scapula on the right side, and after having examined it he proceeded to divide all of the soft tissues holding the angle of the scapula, and attempted to replace the scapula. This was impossible, the adhesions under the scapula being exceedingly firm. After three or four months Dr. Sands had seen the case in consultation. The upper angle of the scapula was then cut off. The case had been reported and published by Dr. Sands about 1887, in the *New York Medical Journal.*

He had seen a good many cases which seemed to be simply a lateral curvature of the spine high up. In some of these cases he had secured good results by the ordinary treatment for lateral curvature, and as the nerve distribution was the same as in torticollis, he would look to some disturbance of the spinal accessory nerve as the cause of this trouble. The cases seemed to him quite rare, and he wished to refer to the case reported by Dr. Sands, as it had been overlooked by Dr. Steele.

Dr. A. H. Freiberg said that the condition was of great etiological interest, though nothing definite was known regarding its causation. There were really three classes of cases. In one class there was associated considerable deformity of the thorax. In the case of this kind which he had reported there was a very high degree of lateral curvature, and this curvature had increased very decidedly since the publication of his cases. In the second class there was simply an elevation of the scapula with a perfectly normal thorax and spine. The scapula here was perfectly movable. In the third class of cases there was a union between the scapula and the spine, or between the scapula and a cervical rib. In the case of the perfectly movable scapula, the second class, Kolliker's proposition to remove the projecting part of the scapula might well be considered in order to diminish the unsightliness. Within the last three months he had seen a case in an infant of about six months, in which there was a marked projection of the angle of the scapula in the root of the neck, but the scapula was movable and the spine and thorax normal. Where there was extreme thoracic deformity there seemed to be little use in operative interference, and the surgeon's efforts must consist in preventing an increase in the deformity.

Dr. Henry Ling Taylor said that several cases of elevated scapula were seen yearly at the Hospital for Ruptured and Crippled, New York. It had been stated that in fœtal life the elevated position of the shoulder was normal, and that in these cases the fœtal condition had persisted. Dr. H. Augustus Wilson had reported two cases in which the elevated scapula was

jointed to the spine of the seventh cervical vertebra by a bony plate. One similar case had recently been observed in Dr. W. R. Townsend's clinic at the Hospital for Ruptured and Crippled.

Dr. H. Augustus Wilson said that the two cases referred to by Dr. Taylor were apparently unique, in that they seemed to be prolongations of the seventh cervical vertebra with distinct articulation in one case with the scapula. The radiograph showed distinct bony prominence, and the operation showed the position of attachment. In one of the cases there were two distinct articulations, one with the seventh cervical vertebra, and the other with the scapula. The resulting conditions were considerable improvement in position; at the present time, very great latitude of motion, very closely approaching normal action of the shoulders. There was no explanation of the condition.

Dr. C. F. Painter said that he had reported two cases last year. One of them was like the case just described by Dr. Wilson. There were two distinct articulations, and the condition appeared to be developmental.

Dr. Steele said that the etiology of this condition was evidently but little understood. It was true, as Dr. Freiberg had said, there were three classes of cases, and the treatment must be modified accordingly.

AN APPARATUS FOR PARALYSIS OF THE EXTENSORS OF THE HAND AND FINGERS.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

A BOY, aged fourteen years, while working in a coal mine, was injured by being crushed between a loaded car and the side of the gangway. He received a fracture of the scapula and clavicle which, after healing, left him with a paralysis of the left upper extremity. The muscles of the shoulder and upper arm and extensors of the hand and fingers and thumb were all paralyzed. He came under my care after the fractures had completely healed. The fracture of the clavicle was first exposed and the projecting bone on its under surface smoothed off. This gave no relief. A long incision was then made along the anterior border of the deltoid muscle and prolonged upward over the clavicle into the neck. This incision was deepened, the clavicle divided, and the whole shoulder pushed backward and the brachial plexus with its various branches carefully examined. No distinct lesion could be discovered. Some improvement in the flexion of the fingers seemed to follow the operation. The clavicle was wired, and healing was per primam. In order to enable some use to be made of the hand an appliance was constructed to extend the fingers by the usual method of elastic cords running from the wrist down over the dorsum of the hand and fastened to leather rings around the phalanges. This was so unsatisfactory and inefficient that it was abandoned and the following applied:

Two side irons passed, one on each side, from well up the forearm to the first (proximal) interphalangeal joint, where they were joined by a rod running from side to side. The apparatus was jointed opposite the wrist, and a spring on each side at

this point served to keep the apparatus in extension. (See Fig. 1.) The arm was laid in the splint, the cross-bar at the end extending across the distal ends of the first phalanges on their palmar surface; two straps fastened the apparatus to the forearm, and a piece of webbing fastened by buckles passed over

FIG. 1.

the dorsum of the hand opposite the metacarpo-phalangeal articulation. (See Fig. 2.) The hand could then be readily flexed by the muscular action present and extended by the springs of the apparatus. To extend the other phalanges a piece of spring wire was passed across their palmar surface from side to side and wound on the cross-bar from its ends toward

the middle, where they were fastened. This formed a coiled spring which tended to raise or extend the phalanges beyond. (See Fig. 3.)

In order to raise the thumb a separate appliance was necessary to produce abduction of the thumb as well as extension. This

FIG. 2.

was accomplished by means of a wire frame made in the form of an oval. This was bent across the middle so that the two halves stood at ninety degrees to each other. Across one of these branches adhesive plaster was wound and the thumb laid thereon and bound to it firmly by additional turns of adhesive plaster. The other arm then projected above the thumb like

an inverted letter ∩. A small elastic band passed from the wire to a band around the wrist. This both abducted and extended the thumb satisfactorily. (See Fig. 4.)

The appliance, as far as the hand and fingers were concerned, worked very well; but the total paralysis of the arm and shoulder

Fig. 3.

above rendered the limb comparatively of little value. The device is particularly applicable to cases of wrist-drop from pressure paralysis of the musculospiral nerve, because in those cases the power of the remaining muscles of the arm is preserved.

FIG. 4.

DISCUSSION.

DR. W. R. TOWNSEND said that the apparatus was certainly very ingenious, but he would like to know why tendon transplantation would not give a more satisfactory result in such a case.

DR. A. B. HOSMER thought that it would be desirable if a similar apparatus could be devised for the opposite condition.

DR. DAVIS said that possibly tendon transplantation might prove useful in similar cases.

REMARKS ON ARTHRODESIS OF THE ANKLE FOR INFANTILE PARALYSIS.

By JOHN DANE, M.D.,
BOSTON.

The condition known as paralytic calcaneo valgus is far too well known to require any further description. Especially is this the case after the admirable paper on this subject read before this Association a year ago by Dr. Whitman. Most of us are accustomed to treat this deformity by means of some form of mechanical apparatus, and if we think of operating at all, to do so when the child is older. The present paper deals, therefore, with only one phase of the problem, and is, in fact, little more than a condensed plea for early operation. The difficulties and disadvantages of apparatus are so familiar to you that the briefest mention of them is all that is necessary. Braces will break, no matter how well tempered the steel; they are steadily being outgrown, and must be replaced by larger ones; each increase in size requires stronger and, therefore, heavier irons, until the weight of the apparatus becomes no inconsiderable burden; when added to that of a paralyzed or partially paralyzed extremity, it often proves too much for the nearest group of active muscles, which are perhaps more or less affected themselves; even in small children the weight and inconvenience of the brace often prevents them from attempting any more movement than is absolutely necessary, or perhaps from any at all; lastly, braces must be retained in position by straps, which necessarily compress the muscles and interfere with their proper nutrition and consequent growth.

In the great majority of cases the onset of the paralysis is before the end of the second year. During the first six or eight

months following there is a greater or less improvement in the symptoms. After that the injured muscles can be benefited but slightly, what increase in function there is coming rather from an hypertrophy of the unaffected groups than from any gain in power of those affected by the disease. A year after

FIG. 1.

Antero-posterior view of ankle after operation—boy.

the onset we can tell with approximate accuracy what the amount of permanent damage has been; and the malposition, due to the action of the remaining groups unbalanced by their natural antagonists, has begun to be indicated.

The first point I wish to emphasize is that at this early period there is neither irreducible malposition of the foot as a whole, nor malformation of any of the separate bones. If left to itself, both of these unfortunate conditions are practically certain to develop. If treated by apparatus, there is little to expect save a lifelong bondage to an iron support, with a possibility at least, if not a probability, that an operation will be required "when

FIG. 2.

Antero-posterior view of ankle after operation—girl.

the child is older," either to rectify a malposition that has developed in spite of the apparatus or to escape from the increasing difficulty of retaining the limb in the apparatus. While fully aware that orthopedic surgery aims, at least primarily, at the treatment of deformity by means of mechanical support, it seems to me that this is one of those conditions in which we can

accomplish our end better by an early use of the knife, supplemented, if necessary, by a relatively simple apparatus.

It is not my intention now to speak of those slighter cases in which a tolerably useful limb can be attained by tendon transplantation in its various forms—Dr. Whitman has left little to be said regarding these—but rather to consider the question, Why do we delay in performing an arthrodesis in the severer cases? In favor of an early operation there are several points to be urged:

1. By avoiding the use of costly apparatus for a period of years a considerable saving in money and a still greater saving in trouble is effected for the parents as well as the child.

2. At an early stage in the trouble the bones are relatively normal, both as regards their shapes and their mutual articulations; nor are there marked malpositions of the foot as a whole, which so often have to be overcome in operations at a later stage. (Had the girl from whom X-ray Fig. 3 was taken been operated at an earlier period—she was nearly seven years old at the time—the marked malposition of the os calcis would not have been encountered and the amount of possible correction would have been decidedly greater than that now shown in the plate.)

3. The tissues are then in a period of great plastic activity, when repair is both quicker and more perfect than in the older child. Cartilage is being changed into bone all through the foot, and we have less fear of a failure to secure bony union at the site of operation.

4. When at an early age the foot is secured in a relatively normal position the statics of the lower limb are not so much disturbed, and growth goes on under more nearly normal conditions than can be possible when there is a constantly increasing tendency to the transmission of weight along abnormal lines.

5. By avoiding mechanical support the unaffected and partially paralyzed muscles are not subjected to the injury inseparable from the use of constricting bands and straps. They have, in consequence, a freer blood supply and develop more rapidly. The improvement in muscular power in the two cases which I have to report was, however, in excess of what I can

account for from this cause alone. Provisionally, I would suggest that it may be due to the rigid fixation of the ankle-joint preventing abnormal movements from overextending the weakened muscles and exciting reflex action, and still more to its giving the child a sense of security which causes it to exercise more freely and naturally.

The one from which X-ray Fig. 1 was taken was that of a boy, aged six years, who was paralyzed when twelve months old, and who was treated by means of a valgus shoe for four and one-half years. Massage and electricity had been freely used. At the time of operation no voluntary muscular power could be detected in any of the intrinsic muscles of the foot, nor the long flexors and extensors of the toes.

The operation consisted in a careful arthrodesis of the ankle by means of the external incision and retention for seven and one-half months in a plaster-of-Paris bandage and splint. Seven months after the operation, without the aid of massage or electricity, flexion and extension of the toes was quite strong, and separation of the toes possible. The medio-tarsal joint was somewhat more movable than in the normal foot, thus giving a certain amount of elasticity in walking, but not enough to cause any weakness or feeling of instability. He walks with a scarcely perceptible limp, and runs well.

The second case—X-rays Figs. 2 and 3—was that of a girl, aged eleven years, paralyzed at two years of age, and treated for the past six years by massage, electricity, and a steel shoe. The feet and legs were greatly atrophied. She had slight muscular power below the ankles, and walked with a bad limp; the foot, which showed a very marked cavus, flopping into a calcaneo-valgus position at each step. In the first operation I failed in thoroughness; as a result there remained an arc of motion at the ankle of thirty degrees, which was constantly increasing. Eight months afterward this was remedied by a second operation, when the joint was rendered immovable. She wore a plaster-of-Paris bandage, and then a very light iron brace for seven months. The muscles showed the same sort

of improvement as in the former case, but to a less marked extent. Her feeling of confidence was such that she wished and was allowed to go skating sixteen months after the second operation.

Fig. 3.

Lateral view of ankle-joint after operation—girl.

Against the early operation two strong objections have commonly been urged. They are (1) the fear of an insecure cartilaginous union, which will make the use of retaining apparatus as necessary as it was before; (2) the danger of injury to the lower tibiofibular epiphysis, causing interference with the growth of the limb and a consequent shortening. Information upon

both of these points is furnished by the X-ray pictures here shown. In all of them the spicules of new bone forming between the tibia and the astragalus can clearly be seen, thus confirming the clinical examination, which showed the bones to be rigidly united. If these two cases show bony union, it would follow that we may expect it in others, especially in younger children. In order to secure this union, I would lay special stress upon the necessity of an accurate approximation of the opposing denuded surfaces. It is not enough to scrape away most of the cartilage and bring the bones "fairly well together." The joint must be thoroughly exposed, and then an attempt made to secure as square a line of contact between the bones as in a "typical" excision of the knee. A lack of this fundamental precaution in the second case made a second operation necessary. X-ray Fig. 1 shows the square mortising of the bones which was then practised. With this precaution I have found it unnecessary to resort to pegging or wiring the bones together; nor do I believe it will ever be necessary if the early operation is adopted, for, as pointed out, the process of ossification is then rapid and sure. Admirable as is the method of Dr. Whitman for later cases, I cannot but feel that it will be found unnecessary in the early cases to shorten the limb by removal of the astragalus; and that the lack of firm bony ankylosis, necessitated by it, will not be so beneficial to the consequent muscular development. According to Wolf's law we can expect that the whole trabecular structure of the astragalus, the lower extremity of the fibular, and, if necessary, the os calcis as well, will be rebuilt, welding them into one organic whole that will remain permanent for life.

Under the second objection, of injury to the growing epiphysis, there are two points to be considered: (*a*) Its destruction; (*b*) irritation. The distance between this epiphyseal line and the field of operation is clearly seen in Figs. 1 and 2; it is so great that its destruction could only arise from the grossest carelessness on the part of the operator. Indeed, it would seem that this danger must be one of theoretical tradition rather than of actual practice. In fact, I should be skeptical whether it is even irritated by the operation, unless this is done intention-

ally. Now it is a well-recognized fact that a moderate amount of irritation of a growing epiphysis acts as a stimulus, and causes not a retardation but an increase of growth, and it has been suggested in Germany that use should be made of this fact in operations upon paralyzed joints. It would, therefore, seem possible that we may in the future be able to replace the old dread of inflicting an injury upon the epiphyseal line, with its resulting shortening of an already atrophied limb, by a logical attempt to cause an increase in its growth through a judicious irritation of the epiphysis at the time of operation. This can only be demonstrated by careful series of measurements, which, as yet, I cannot give, but I hope at some future meeting to be able to bring before you.

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DISCUSSION.

Mr. Robert Jones, of Liverpool, England, sent a letter to Dr. Dane, in which he called attention to a brief paper that he had presented to the British Medical Association in 1894. He stated in this letter that he had now operated upon 140 cases, performing arthrodesis of the ankle, and was becoming more and more convinced of the great utility of this operation. It was more especially useful in cases in which some little power was left in the muscles governing the joint. In such cases he now did an arthrodesis, with the object of only partially ankylosing the joint and giving the muscles a much better opportunity of becoming strengthened by being prevented from overstrain. He

was of the opinion that it was almost impossible to bring about suppuration in operations upon paralytic joints. In only three cases had he observed a breakdown, and in not one of these ankle cases had the joint itself been affected, the trouble having been superficial. This was a point well worth future study and investigation. When the calcaneus was very marked, and at the same time there was some slight power in the tendo Achillis, he makes an incision at the back of the joint instead of at the front, and at the same time shortens the muscle. He thought it interesting to note the considerable recovery that takes place in apparently paralyzed muscles after immobilization. This was probably due very often to the fact that overstretched muscles have an opportunity to recover—indeed, precisely the same thing happened in cases of paralysis of the extensors of the hand after the wrist had been immobilized in a hyperextended position.

In conclusion, Mr. Jones said that he would try to be present at the next meeting of the Association, and meanwhile desired to be remembered to his friends in the Association.

Dr. N. M. Shaffer said that all were interested in the points specially made in the paper. If this operation could be placed upon a satisfactory basis, as Dr. Dane had certainly shown it could be, it was one which should appeal to the entire Association. The technique must be determined by time, though apparently the mortise joint was a secure one.

Dr. H. P. H. Galloway asked Dr. Dane's opinion regarding the effect of such an extensive operation upon the astragalus upon the future development of that bone.

Dr. B. E. McKenzie said that his own observations would not bear out the position taken by the author regarding the effect on the epiphyseal cartilage. He had in mind the case of a boy who fell from a horse and received an injury to the epiphyseal cartilage at the end of the femur. Subsequently the inner condyle was carried downward, and knock-knee of that limb resulted. A similar condition had occurred in a child

who was operated upon in New York city for disease of the lower end of the femur. The operation described extended down to the region of the epiphyseal cartilage, and the same result occurred—*i. e.*, interference with the growth of the cartilage at the outer part and gradually increasing knock-knee. From an experience with three cases in which he had operated for deformity of the foot, because of cessation of growth in the lower end of the tibia, it looked as if irritation produced there, either by disease, such as osteomyelitis, in the one case, or by fracture near the epiphysis, would do harm. There should be sufficient room, as intimated in the paper, to make an excision of the joint without invading the cartilage itself, yet the increased physiological action resulting from the process of healing, he thought, might easily bring about an early synostosis, and hence prevent further growth in the lower end of the tibia.

Dr. G. G. Davis said that one objection to arthrodesis was that it is to be done in young children in whom the bony tissue is very little developed. The difficulty was to get bony union, and he was glad that Dr. Dane had succeeded in securing this. He had himself tried it, and the bones did not seem to unite as satisfactorily as in adults where two freshly-cut bony surfaces were brought together. In children before true bony union occurred the foot is again turned out by pressure; in other words, in order to obtain bony union he believed the joint must be immobilized for a very long period of time because of the softness of the tissues. In paralysis of the anterior muscles of the leg the foot was not only affected at the ankle-joint, but the toes drop down from the subastragaloid joint; hence, an operation on the ankle-joint alone would hardly correct the toe-drop, and an appliance would be required to keep the toes up, or an additional arthrodesis there.

Dr. Dane, in closing, said that the larger amount of slicing would be on the tibia, and he had not found it necessary to go very deeply into the astragalus. He had already started a series of accurate measurements, and hoped in two years to be able to report to the Association the growth occurring in these cases.

The centre of active growth was at the epiphyseal line, and several investigators in Germany had done considerable experimental work on this point. The growing epiphysis had been irritated in various ways, and the reports indicated an increase of growth amounting in the case of one to 3 cm. He could not answer this question more definitely at present. He did not take up the subastragaloid operation, preferring to confine his remarks to the ankle-joint. If the latter joint were loose he would do the same operation there, so that, as the bone grew, the tibia, astragalus, and os calcis would become one organic structure. In his small series of cases he had secured bony union. He thought the failures to secure such union in young children might be due to an imperfect method of doing the operation. The text-books had made no plea for the accurate approximation with absolutely square mortising.

REPORT OF A CASE OF FRACTURE THROUGH THE SITE OF AN EXCISION OF THE KNEE.

By H. P. H. GALLOWAY, M.D.,
TORONTO.

J. W., aged forty years. Five years ago had an attack of gonorrhœa, which was cured in a comparatively short time. Was again exposed in May, 1899, but declares positively that he contracted no disease. In June, 1899, he developed a swelling in the right groin, which his physician called a "sympathetic bubo." This swelling was quite painful, and at the end of a week was lanced. Was laid up for three weeks and returned to his work as a lumberman late in July. Occupation required great exposure to wet. In October a swelling formed near head of the right fibula. This was opened by his physician and discharged freely for several weeks. Again returned to work, but in a few days the whole leg and lower part of the thigh became greatly swollen, and he was forced to take to bed. From December, 1899, to May, 1900, various incisions were made in the leg and thigh in the neighborhood of the knee-joint, from which free discharge of pus issued. States that he had high temperature, and that blood-poisoning was feared. The leg became greatly flexed, and in the latter part of the summer of 1900 an effort was made to forcibly straighten the knee under anæsthesia.

When I first saw the patient the knee was flexed at an angle of about one hundred and thirty-five degrees, subluxated, and rotated outward. There was almost complete ankylosis in this deformed position. The limb was scarred by numerous recently healed sinuses, and was quite tender when handled. General health considerably reduced.

He entered the Toronto Orthopedic Hospital on August 31, 1900, and after spending a short time in efforts to improve his general health, I excised the joint on September 18th. In freshening the bones Fenwick's incision was used. The dressings were never disturbed for six weeks, and on removing them the wound was found healed. The patient wore a posterior splint for several weeks longer, and before the end of the year firm bony union had occurred. As he was found to be a handy and industrious man he became an employé of the hospital, assisting in the care of male patients and doing such chores as were required.

On the morning of June 13, 1901, nine months after the excision, he was engaged in washing the veranda floor with the hose. He stood upon the edge of the veranda, just at the landing of the steps leading up to it, and as the more distant part of the floor was finished he began to back down the steps so as to avoid playing the water on the floor at too close range. He intended to back down one step at a time, but, by an unfortunate miscalculation of distance, missed the first step, and the whole weight of his body came violently upon the stiff leg as he found footing upon the second step. He felt the leg give way under the strain, and fell to the ground. He tried to rise, but found that there was movement at the site of the excision, and realized that the leg was broken. I saw him within five minutes of the time the accident occurred. He was pale and suffering from shock, there was movement at the place where the excision had been made and considerable swelling. The limb was bandaged upon a posterior splint, fairly firm pressure being made over the seat of the fracture by a thick covering of absorbent cotton beneath the bandage. When this dressing was removed a week later the effusion of blood beneath the skin at the injured part was found to be so considerable that in order to avert threatened sloughing of the skin from pressure the blood was withdrawn by aspiration. After this had been done the line of fracture could be felt very plainly. Serrations as much as three-eighths of an inch in length extended upward into the femur and downward into the tibia, showing that the artificial union effected between these two bones by the excision had been exceedingly firm. The limb was encased in plaster-of-Paris. In three or

four weeks the patient began to go about on crutches, and within two months was able to go to work, wearing a posterior splint. I last saw him a few days ago. The limb was strong and useful, and he was working every day in a lumber mill. He said that he had not worn his splint or protected his limb in any way for several months past.

ON FASHIONING APPARATUS FOR FLAT-FOOT AND DEFORMITIES OF THE TOES.

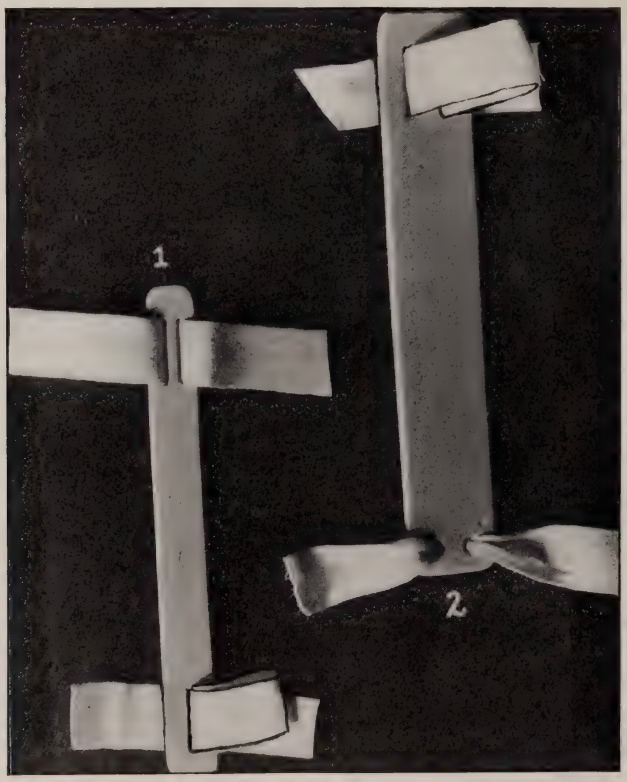
By ALBERT H. FREIBERG, M.D.,
CINCINNATI.

The reports of German writers having made it appear that a desirable material for flat-foot supports had been found in celluloid, a test of this material was undertaken. Difficulty in the manipulation having been encountered, a report of a method of working it, and in a preliminary way, an experience with it was given in the *Boston Medical and Surgical Journal* of November 8, 1900. In this article it was suggested that the method designed primarily for working celluloid might possess advantages over previous methods in the fashioning of metal braces for flat-foot.

Painstaking trial has convinced me that celluloid will not answer the requirements which may be expected of it, at least for adult patients. In order to withstand the body weight it has, in adults, to be used of considerable thickness. In spite of doing this, the celluloid brace has not been found sufficiently durable. It appears impossible to secure material of sufficiently uniform characteristics, so that in patients who are at all heavy the brace is liable to break within a very short time. If this is fortunately escaped, it will be found again in heavy patients or in the case of decidedly flat-foot that the brace fails to hold its shape. In children, on the other hand, celluloid may be at times employed to advantage. It has seemed better, however, to abandon its use altogether for valgus plates.

Familiarity with the use of celluloid has, however, shown it to be a material possessing advantages in the treatment of hallux valgus and as well in the treatment of hammer-toe, where

these are still amenable to mechanical methods. For hallux valgus celluloid is used to make an adductor, for which purpose a piece one-eighth of an inch thick, one inch wide, and from five to seven inches long is taken. Tape of five-eighths inch width being used to secure the splint, slits of this length are made near one extremity, through which a loop can be passed



1. Plantar splint for hammer-toe. 2. Adducting splint for hallux valgus.

to engage the great toe. Near the other extremity the tape is passed through two holes, and is used to bind the splint to the mesial aspect of the foot, passing around the dorsum and sole. The degree of adduction is regulated by bending the splint in hot water. This splint is used as a night appliance

only, either with or without the use of a toe-post for day wear, as the case may require.

For hammer-toe, material one-sixteenth of an inch in thickness is employed. At first a strip one-half inch in width and of suitable length is fastened to the plantar surface of the toe by means of adhesive plaster. This is renewed at intervals of a few days until the toe has become quite flexible. After this the splint may be fastened to the toe and foot by means of soft tape through slits and in a manner similar to that mentioned above. These splints have been used with satisfaction in quite a number of cases for the past year.

In fashioning metal plates for flat-foot it has been found very satisfactory to use the method above referred to. It may be permitted me to briefly describe this as at present employed. The impression of the sole of the foot is first taken by lightly but thoroughly painting the sole of the foot with the following solution:

Tinct. ferri chlorid.	50
Alcohol (80 per cent.)	45
Glycerin.	5

A cotton swab is used for this purpose, and the patient is made to step upon a piece of white card-board to secure the impression. While bearing his weight upon the card-board a pencil is used to draw a contour of the foot, being especially careful along its inner border and in the region of the astragalo-scaphoid articulation, in order that the amount of pronation may be estimated. It is well at the same time to measure with a tape the distance from the inner border of the foot to this articulation when the weight is taken off, in order to ascertain the required height of the inner flange. While the patient is still standing one may also note upon the card the points corresponding to the anterior tubercle of the os calcis and the middle of the fifth metatarsal bone, respectively. The impression may now be developed by painting the card with a concentrated alcoholic solution of tannic acid. This impression is used to make a pattern of the brace. This pattern is made on paraffin paper, which is superimposed upon the impression, and with a pencil the pattern may be drawn, the footprint in plain view. The

shape of this pattern will vary according as one wishes to produce one form or other of brace. The pattern is reproduced in four-pound sheet lead. With a horn hammer the lead pattern is now hammered by guess into the shape of the future brace. In doing this the impression of the foot with its contour is kept in view as a guide. This having been done the patient returns, and the pattern is fitted to his foot. After the pattern has been fitted a plaster cast is taken of its upper surface, and this cast is sent to the artisan from which to make a metal brace.

It is practicable by making use of this method to produce any type of brace with which I am acquainted. Three forms have been used by me within the last two years. The Whitman brace and a brace recommended by Lange[1] are the forms in which resistance at the outer border of the foot is offered by means of flanges. Lange's method has been recommended in a somewhat different form by Sampson.[2] In this brace an adducted position of the foot is produced by having two external flanges, the one making pressure upon the outer border of the foot posterior to the flange of the internal border, therefore against the os calcis. The second external flange is placed so as to impinge upon the fifth metatarsal at about its middle. Both the Whitman and Lange braces are exceedingly efficacious, the latter being especially adapted for cases in which abduction and pronation are features more prominent than the flatness. The most valuable suggestion, however, may be found in the article on "Pronation and Its Relation to Treatment," by Hoke and Bradford.[3] In this article it is shown how the lifting force should be applied to the internal cuneiform and how the lift should be carried forward to the third and fourth metatarsal bones.

In no other manner which I have tried can the amount and position of the lift which is to be given to the internal arch be determined so well as in the method which I am recommending. This is even more true of the arching of the metatarsus above referred to, and which I have found exceedingly important. A much greater lift is borne by patients when this arching is made. The brace when made in this manner can, of course, be provided with external flanges also. I have found, however,

that these are rarely necessary if the foot is thoroughly flexible, and of course it should be so before the application of any brace. The brace when made in this manner has of itself the appearance of a supinated position, and the foot will apply itself to this in a very satisfactory manner.

In case external flanges are to be used, it is best to leave them flat on the lead pattern and, when fitting the pattern, to bend these to the outer border of the patient's foot. This is for the reason that it is otherwise difficult to tell what amount of pressure is required or can be borne. It is also well in the pattern to have both external and internal flanges somewhat longer than necessary. They may then in the fitting be cut to their required length by means of shears.

In a recent article Nicoladoni[4] has suggested that in those severe cases of flat-foot with convexity of the sole the flat-foot brace as usually made is inefficient. According to him the brace, made to act well enough in the standing position, loses its effectiveness in the act of walking; during this, instead of transferring the weight from heel to metatarsal heads by means of the longitudinal arch, the sole rolls off the plate as if it were unsupported. In order to counteract this he proposes to use a support convex not only upon its superior aspect, but also upon its inferior. In this way, instead of rolling off the convexity of the sole, the foot rolls by means of the convexity of the support, the vault being all the while supported.

He offers a more practical solution in the form of a brace in which the whole plate is to oscillate upon a pivot placed horizontally at the medio-tarsal joint.

It must be confessed that in the case of many supports Nicoladoni's objection holds good. This is, however, for the reason that the slope forward and downward from the highest point of the lift in the plate is not sufficiently abrupt, or, to refer again to the paper of Hoke and Bradford, the great metatarsal is not allowed to flex. If the support is made simply from a corrected plaster cast this point is not likely to receive the proper attention. With the lead pattern, on the other hand, it is easy to determine the amount of flexion allowed to the great metatarsal.

With the plate properly made in this way I cannot see how Nicoladoni's objection can hold. On the other hand, it appears to me that with the adoption of any plan like that suggested by Nicoladoni we abandon all hope of restoring to the flexors of the toes any of their lost capacity for helping to maintain the arch, and, in addition, cause the patient to wear an apparatus more complicated, clumsier, and, I venture to say, not more efficient than the old form, if properly fashioned.

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2. Sampson. Amer. Med., January, 1902.
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4. Nicoladoni. Deut. Zeit. f. Chir., Bd. 63, p. 166.

DISCUSSION.

Dr. Harry M. Sherman said regarding the taking of prints of the sole of the foot, that his own method seemed very convenient and simple. It consisted in rolling out printers' ink on a cracker-box cover, having the patient step on this and then upon a card on which the impression is to be made. No development was required by this method, and the ink could be readily cleaned off the patient's foot with benzin and a swab of cotton.

Dr. John Ridlon said he was accustomed to roll the ink with a rubber roller out on a slate and let the patient first step upon the slate and then upon the paper.

Dr. A. H. Freiberg said that he had tried this method but had found printers' ink very disagreeable to work with. The method that he had described seemed to him much more cleanly. Nothing was left on the foot but a little chloride of iron. The developing consisted in painting over the card with tannic acid solution, which dries very quickly. A small portion of glycerin was added, with the intention of preventing the running of the solution. The iron solution was easily washed off the foot. He could take the impression and clean the foot while another was merely engaged in cleaning off the printers' ink.

THE PASSIVE CARRYING FUNCTION OF THE ARM: ITS IMPORTANCE, ITS DESTRUCTION, AND AN OPERATION FOR ITS RESTORATION.

By PHILIP HOFFMANN, M.D.,
ST. LOUIS.

The normal arm is not a straight one. The forearm articulates with the upper arm at an outward angle of about 170 degrees instead of a straight line. Consequently, the forearm diverges from the line of the body when the upper arm is held parallel to it. This divergence of the forearm is due to the fact that the plane of the articular surface of the lower end of the humerus is not at right angles to the axis of the shaft; but that its inner extremity is lower than its outer, so that a line passing through it would form an inward obtuse and an outward acute angle with the shaft of the humerus, each varying on an average of about 10 degrees from a right angle. (Figs. 1 and 2.)

This angular junction of the two segments of the upper limb is of considerable value in the mechanics of the human frame, and its loss through any cause leads to inconvenience. Normally, weights can be carried in one or both hands with no more expenditure of muscular energy than that required in holding the hand closed, the only muscles used being the flexors of the hand. The upper arm remains a passive agent, and the weight is held away from the thigh by the outward angle at the elbow. (Figs. 1 and 7, and left arm of Fig. 5.)

Destruction of this outward or "carrying" angle may be brought about by various elbow fractures, by distortion from rachitis, or by anything that changes the direction of the articular surface from one facing slightly outward to one facing

directly downward or slightly inward. In the latter case the normal angle would be reversed and open inward instead of outward, giving rise to the condition commonly known as gun-stock deformity or cubitus varus. (Figs. 3, 5, and 6.)

FIG. 1.

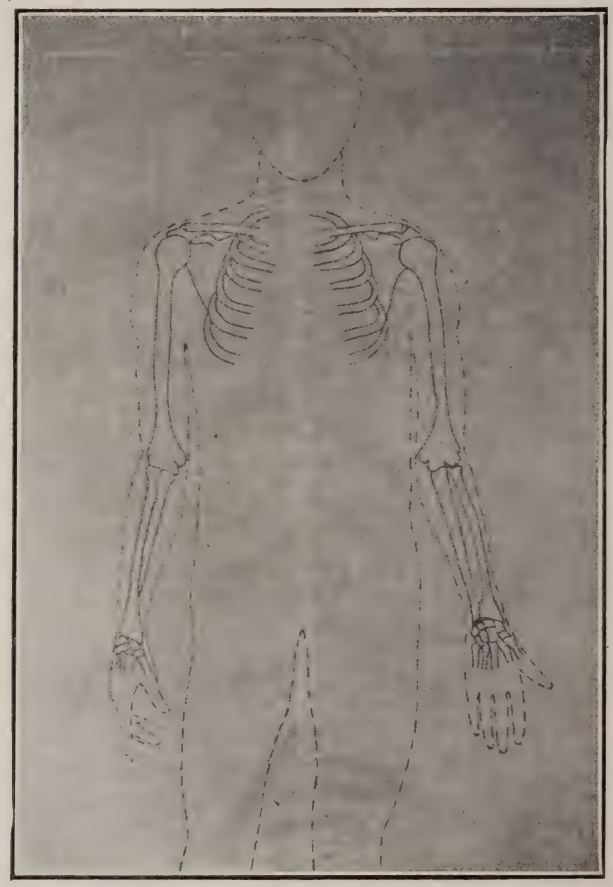


Diagram of normal skeleton. Forearms held from sides by lateral elbow angles.

That this deformity is a common result of fracture at the elbow is evidenced by its frequent mention and illustration in many of the works on surgery, including even the old ones.

Allis[1] taught that its usual cause is fracture through the internal condyle and trochlea with upward displacement. Later investigations seem to show that it is most frequently due to supra-

FIG. 2. FIG. 3. FIG. 4.

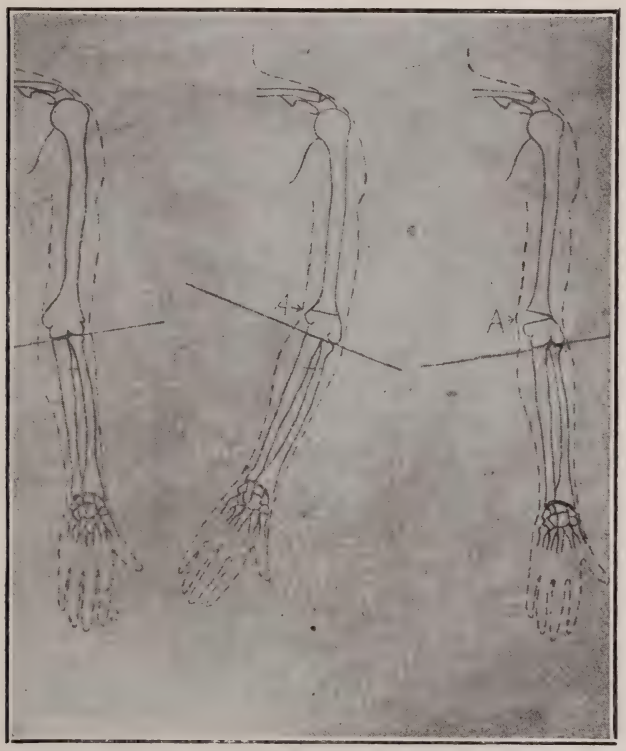


FIG. 2.—Normal arm, showing carrying angle. Articular surface of humerus faces slightly *outward*. Forearm joins upper arm at an *outward* angle.

FIG. 3.—Deformed arm before operation, showing loss of carrying angle. Articular surface of humerus faces slightly *inward*. Forearm joins upper arm at an *inward* angle. *A*. Line of osteotomy.

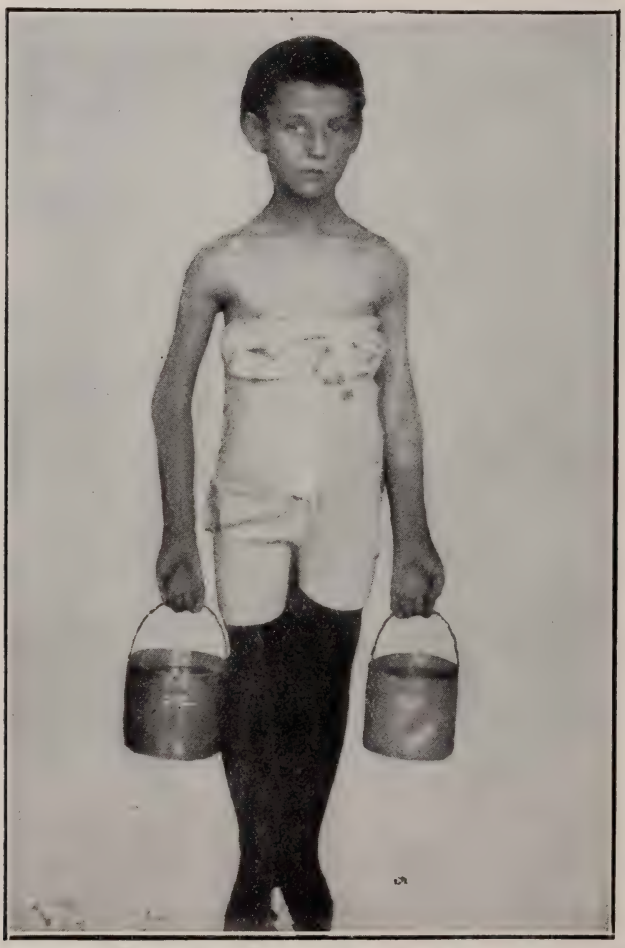
FIG. 4.—Same arm after operation, showing new carrying angle above joint. *A*. Triangular gap to be filled with new bone.

condylar fracture. However, Allis, by his classical writings, caused it to become generally recognized, and was the first to suggest rational means for its prevention.

[1] Annals of Anatomical and Surgical Society, Brooklyn, 1880, vol. ii., No. 8.

When the passive carrying function is lost a substitute must be provided to prevent a weight carried in the hand from striking the thigh and interfering with locomotion. The only device at

FIG. 5.



Before operation. Bucket in right hand kept from crossing thigh by action of shoulder muscles. That in left, by normal elbow angle.

the disposal of the human machine to compensate for the loss of this normally passive function is muscular activity. The muscle best adapted to assume this function is the deltoid,

which carries the arm directly from the side. In this action it receives assistance from the supraspinatus. It is further assisted by the trapezius, which elevates the point of the shoulder.

FIG. 6

After operation. Bucket in right hand kept from crossing thigh by *new* carrying angle above joint. Some thickening above elbow from callus.

If one considers the relative positions of the shoulder-joint, the attachment of the deltoid to the humerus, and the hand carrying the weight, it will be plain that the deltoid is acting at a great

disadvantage; in fact, the mechanism is that of a lever of the third class in which the power is placed between the weight

FIG. 7.

Right arm before operation.

FIG. 8.

Right arm after operation.

and the fulcrum. In this mechanism the upper limb is the lever and the head of the humerus its fulcrum. The power is represented by the attachment of the deltoid into the humerus,

and the weight (or resistance) by the hand and its contents. As the distance from the weight at the hand end of the lever to the head of the humerus, or fulcrum, is about four times that of the humeral insertion of the deltoid, or power, to the same point, every pound held in the hand will exert about four pounds of pull upon the deltoid. Consequently, even a small weight will be a considerable burden to carry in this manner. That even the weight of the limb alone, held a few inches from the side for several minutes, is tiring, can be readily proved by simply trying it. Fig. 5, a photograph of a child whose right arm shows a gunstock deformity, illustrates the action of the deltoid and trapezius. It is of interest to note that, despite this action, the bucket on the deformed side is held in contact with the thigh as if to give the shoulder muscles as little work as possible. The weights employed here were about three pounds each.

Even in walking without weight-carrying, the deformity would be a source of annoyance, for, if the arm were allowed to hang at the side, the hand would tend to cross in front of the moving thigh, from which it would have to be held by action of the shoulder muscles. It is curious and worthy of note that deformity of the elbow should lead to strain, not at the elbow, but at the shoulder.

Flexing the elbow and rotating the arm outward also would suffice to carry the hand away from the thigh; but this would lead to even greater muscle exertion than the shoulder action.

The passive carrying function is one of considerable importance, and its loss no small deprivation.

Gunstock deformity leads not only to interference with the carrying function, but is also unsightly and causes awkwardness in using the arm.

The writer recently performed an operation that he had for some time contemplated resorting to in the first suitable case that presented itself for treatment. The patient, aged ten years, had a typical gunstock deformity of the right arm following fracture and upward displacement of the inner condyle, sustained nine months and a half before. (Figs. 5 and 6.)

One method of treatment that naturally suggested itself was

to loosen the misplaced condyle from its abnormally high attachment and bring it with the attached ulna into the normal position, but, as the patient could fully extend the elbow and could flex it to beyond a right angle, I feared that a bone operation involving the joint might interfere with one or both of these motions.

As the misplaced condyle produced the deformity by changing the plane of the articular surface of the humerus from one facing slightly outward to one facing slightly inward, the conclusion was reached that an operation reversing the articular plane to its normal direction would suffice to correct the fault, and that this operation could be performed without interfering with the joint surfaces.

Several methods presented themselves, but I chose what appeared to be the simplest, and made a section of the humerus just above the inner condyle at the point marked A in Fig. 3, and bent the forearm with the lower humeral fragment outward, which left a triangular gap to be filled with new bone. (See A in Fig. 4.) This established a new carrying angle *above* the joint, which, for practical and cosmetic purposes, served as well as did the original one at the joint. The result, while not an anatomical restitution, was, functionally, a good one. This, I think, the photographs show. (Figs. 7 and 8.)

I operated by the open method for fear of wounding the ulnar nerve. In a normal arm this nerve could be readily avoided during a subcutaneous osteotomy, as the ridge formed by the intermuscular septum, behind which the nerve lies, would serve as a guide. In the case related, however, the septum was much relaxed by the elevation of the condyle, and could not be readily outlined. This made it safer to carefully dissect through the soft parts before making section of the bone, which was then divided with a three-eighths inch Macewen osteotome and mallet. The fragments were neither wired nor nailed, and the wound was closed without drainage. The arm was bent to correspond in contour as nearly as possible to the normal one, and was fixed in extension by a plaster-of-Paris dressing. At the end of the third week, good union being present, the plaster splint was removed, but the child was not allowed to carry weights for six weeks thereafter.

When performing this operation it is well to remember that the musculospiral nerve lies to the outer side of the humerus. To avoid injuring it the bone should be cut only three-fourths through and then broken. With ordinary care there is little or no danger of wounding the brachial artery or median nerve.

The reasons for dividing the bone from the inner side are: First, any operation on the outer side may directly or indirectly involve the musculospiral; second, after simple section from the inner side the bone is broken in a direction away from the cut and toward the position of correction. This will leave an unbroken covering of periosteum on the outer side; third, simple section on the inner side will give a longer arm than a cuneiform operation on the outer. That the triangular gap left by separation of the bone surfaces will invariably be filled with new bone is demonstrated well by the results of innumerable similar operations performed for bow-legs and knock-knee.

An explanation of how the diagrams Figs. 2, 3, and 4 were made may be of interest. First, Fig. 2 was drawn to represent a normal arm; then the inner condyle and trochlea were cut through and the fragment with the forearm attached slipped upward. This was retraced and all sharp projections rounded, and the result was Fig. 3. This, in turn, was divided above the elbow at the point marked A, and the forearm carried outward. A tracing of this gave Fig. 4. Thus it will be seen that the diagrams accurately represent the case here reported. It is astonishing how closely the diagram of the corrected arm resembles that of the normal one, also that the lengths of the two are equal. Examination of the photographs will show that the same occurred in the living subject.

At the time this report was written the writer believed that his was the first operation ever performed for the relief of gunstock deformity. This belief was founded upon his inability to find reference to it in the mass of literature then at his command and upon negative replies to diligent inquiries made of numerous surgeon friends.

Within the past few days, however, he has discovered that several surgeons, each independently, have performed operations for the relief of this deformity.

Tilanus[1] operated in one case, dividing the humerus from its *outer* side. This was followed by temporary paralysis of the musculospiral nerve.

G. G. Davis,[2] one of our members, operated upon three cases with satisfactory results. In two an electric drill was used to divide the bone; in the third he used an osteotome. The division in each case was made from the inner side.

Brackett, in a case of severe gunstock deformity following elbow fracture, performed an open cuneiform osteotomy from the outer side with good result. This case is cited by Cotton in an exhaustive paper on "Elbow Fractures in Children."[3]

The risks of operation should be very small. Very few ill results have followed the thousands of osteotomies performed for the correction of bowlegs and knock-knee. Macewen,[4] in 1884, collected 1384 cases of osteotomy of the femur, of which three died after operation. With our improved methods of asepsis fatalities should be reduced to practically nothing.

DISCUSSION

Dr. Charles F. Painter said that Dr. Cotton had made a very exhaustive study of this subject. Dr. Cotton had just published a long article, exhausting the literature to date. According to this author's statistics, Kocher had done two, Koenig one, Pichot one, Brackett one, Goldthwait one, W. F. Gay one, the last two mentioned not having appeared in the literature. This, with Dr. Davis' cases, made a total of eight operative cases of this kind now on record. According to the experience of men who had studied this subject, notably Kocher and Bouchet, the causation was almost invariably a transverse fracture above the condyles. In Cotton's analysis that was invariably the cause. The importance of the deformity from the standpoint of orthopedic surgeons was that this deformity caused a true scoliosis. In our own three cases this had occurred. The interference

[1] Deutsche Zeitschrift für orthopädische Chirurgie, 1891, vol. ii.
[2] Annals of Surgery, January, 1899. [3] Ibid., March, 1902.
[4] Lancet, London, September 27, 1884.

with the carrying function of the arm had resulted in such anatomical defects that a true rotary lateral curvature had taken place. One case was that of a female, twenty-one years old, seen first in December, 1897. She had had a fracture resulting from a serious accident. At the first visit extension, pronation, and supination were all limited. She had marked round shoulders, with a lateral curve and convexity to the left in the lumbar region. Operation was advised but refused. It was evidently the cause of the curvature, which did not develop until after the accident. Another case was that of a male, thirty years of age, first seen July 7, 1898. When six years of age he had sustained fracture of the right elbow, and the right arm was then abducted and could not be extended, and the muscles were flabby. The spine was found to be curved. The case was Dr. Goldthwait's, and Dr. Goldthwait had written to a number of the members of this Association asking their opinion regarding the performance of the operation just described by Dr. Hoffmann. The replies were unfavorable, and hence Dr. Goldthwait had not done the operation. There was a mild scoliosis present. A third case was that of a male, three years of age, who, according to the family physician, had sustained a dislocation of the radius on December 15, 1900. This dislocation had been reduced by the local physician, and later a second injury had displaced the bone again. On coming under observation the right arm could be flexed to a right angle, and could not be fully extended. As the arm straightened there was abduction of the forearm, apparently due to thickening of the outer condyle of the humerus, as proved by an X-ray examination. This case had been operated upon with a perfectly successful functional as well as cosmetic result.

Dr. G. G. Davis said that the Association was indebted to Dr. Hoffmann for pointing out another functional disability resulting from this injury. The question was as to the advisability of operating upon it. These cases were met with not infrequently by general surgeons who treat fractures. As the patients insisted that the use of the arm was perfect, it was difficult to obtain consent to operation. Dr. Hoffmann had pointed out some of the disabilities, and Dr. Painter had just called attention to the

scoliosis produced by this injury. This constituted another argument in favor of operation. The danger of the operation, osteotomy, was comparatively slight. A German surgeon—Rieffel—had reported operating upon one of these cases some time before his own case. The latter had been reported a few years ago in the *Annals of Surgery*. The first operator operated from the outside, following Macewen's method of osteotomy of the femur. His own opinion was that it was better to cut from the inside of the angle, so that when the angle was opened the remaining periosteum formed a hinge. If the osteotomy were done on the opposite side, the separation of the bone was unnecessarily extensive. Another objection to operating upon the outside was the danger of injuring the musculospiral nerve; indeed, this was what occurred in the case operated upon by the first-mentioned operator, and the result was a temporary paralysis. This accident could be avoided by an open section and by keeping carefully away from this nerve.

Dr. Galloway said he believed it to be the experience of most surgeons that fracture of the humerus was more apt to be followed by non-union than fracture of other bones; hence, it seemed to him that a cuneiform osteotomy would be preferable.

Dr. Sherman said that Dr. Painter had added an interesting point with regard to the ultimate result of this injury. He had always considered that the loss of carrying power was the only disability. He had seen a number of such patients. One of them was an exceedingly athletic individual, who was known in college as a redoubtable boxer. This man said that his crooked arm helped rather than hindered him in his boxing. Once he had detached the internal epicondyle and had secured a correction, but the part had already become wobbling. This was in 1900 or 1901. Stimson's paper had then described the true nature of the injury, and he had subsequently done a subcutaneous supracondyloid osteotomy on this same patient. He was unable to give the result of this second operation because the little patient had been taken to Manila.

Dr. Hoffmann said he was glad that Dr. Painter had called attention to the possibility of scoliosis occurring after this injury. He had thought of doing the subcutaneous operation, and would have done it if the internal intermuscular septum had not been so much relaxed that it seemed to him to offer greater risk of injuring the ulnar nerve. As to possible nonunion in a simple osteotomy, he did not think it was very apt to occur. In his case the splint was removed in about eighteen days, and good callus had already formed. As to the deformity, if the patient finally became accustomed to it, it might not cause great inconvenience; nevertheless there was a decided disability, as shown not only in weight-carrying but in various movements of the limb, as carrying fork and spoon to the mouth.

A FRAME FOR THE APPLICATION OF PLASTER-OF-PARIS JACKETS IN POTT'S DISEASE.

By ROBERT W. LOVETT, M.D.,
BOSTON.

Plaster-of-Paris jackets in Pott's disease are applied by many methods, and much discussion as to the relative value of these methods has taken place without having succeeded in uniting the medical community on any one plan in preference to others.

The object of the jacket is, of course, to hold the spine in such a position that pressure between the diseased vertebræ shall be diminished as much as possible. Under the best conditions there should be slightly less backward deformity in the jacket than without it. That is, the spine above the diseased part should be bent slightly backward at the site of the disease. The whole spine need not be hyperextended, and the more accurately the force can be localized at the seat of the disease, the more satisfactory it would seem to be from a mechanical point of view.

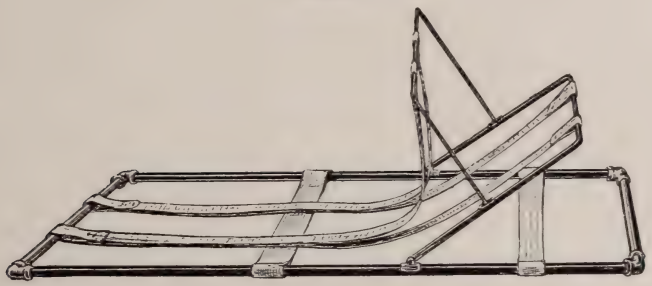
A practical requirement of the jacket in dorsal disease, too often overlooked, is that it should come up high in front, pressing back the sternum, shoulders, and upper lateral part of the chest.

The apparatus here described has the merit of being cheap and simple. It locates the hyperextending force at the seat of the disease and allows the jacket to be closely applied against the upper part of the chest and shoulders.

Several experiments have been made with it in the case of children by taking a tracing of the deformity while the child lay on its face, before the application of the jacket. After the

jacket was hardened a long strip down the middle of the back of the jacket was removed, about an inch wide, and another tracing taken through the slit, showing in all cases a very marked diminution in the deformity. In no one of the cases was anything but a mild degree of force used.

FIG. 1.



Gas-pipe frame, with movable piece raised.

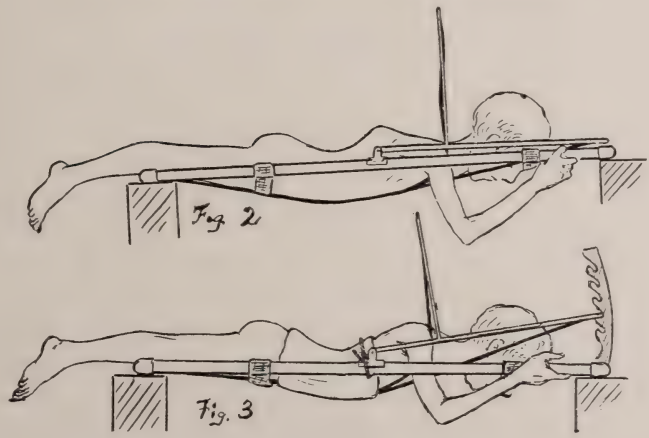


FIG. 2.—Patient on frame before application of jacket.
FIG. 3.—Lower part of jacket applied. Frame raised to hyperextend spine.

The apparatus consists of an oblong gas-pipe frame of the ordinary pattern. Fastened to this near the middle, and hinged so as to be raised to any degree, is another section of gas-pipe lying on the frame proper and of the same shape and size as the upper half of the frame. To this movable section is fastened,

at right angles to it and movable on it a gas-pipe bridge rising about eighteen inches from the movable section.

Instead of lying on a hammock the patient lies face downward on two straps of webbing one inch wide, running from buckles attached to the bottom of the frame, to buckles attached to the end of the movable section. A cross-piece of webbing, padded, runs across the movable section and furnishes a head-rest, another cross-piece of webbing runs from side to side of the main frame and comes just below the pelvis, and another cross-piece running from side to side of the main frame supports the legs. The cross-pieces should be fastened below the longitudinal strips, to prevent sagging of the latter.

One of the chief difficulties in the application of jackets by the hammock method lies in the fact that if the hammock is at all tight it stands away from the upper part of the chest and shoulders, unless a hole is cut for the head, which sacrifices some of the good position. If the hammock is very slack the whole spine is hyperextended, and it is obviously better to limit the hyperextension so far as possible to the diseased section, and to have the rest of the spine, so far as possible, straight.

For the purpose of enabling the jacket to be closely applied to the upper part of the chest, the bridge attached to the movable section was added to the original frame; without it the apparatus is much the same as the ordinary hammock frame, except that no windlass is necessary.

When prepared for use two strips of webbing lying one over the other run from each of the buckles at the bottom of the frame. The lower pair of these strips are tightly drawn and run to the buckles at the end of the movable section, the upper pair are loosely fastened to the bridge over the movable section. The cross-pieces are tightened and the patient laid face downward on the webbing strips, which may, if desired, have laid over them a folded piece of sheet wadding. The strips, however, even in adults, are not uncomfortable. The patient should be placed in such a way that the seat of disease comes opposite the hinge where the movable piece is attached, and the head and pelvic webbing supports are adjusted to their proper places.

The deformity must be very heavily padded by thick pads

placed on each side of it. A jacket is then applied in the usual way, up to and only as far as the level of the apex of the deformity, and allowed to harden. If a quick-setting plaster is used this is a matter of only a very few minutes. After the plaster has hardened a piece of webbing or stout cotton bandage running from side to side of the main frame (not attached to the movable section) is passed over the upper back edge of the jacket and firmly fastened to the sides of the frame. This is to furnish the resistance for the hyperextending force, and must be firm.

When this is fastened in place the movable section of the frame is lifted until the desired correction is obtained at the seat of the deformity. It is easy to see by inspection, as well as to feel by the amount of resistance, how much is being done. When the desired point is reached the movable section is fastened in position and a few turns made with a plaster bandage, going up two or three inches above the deformity. Then the straps running to the end of the movable section, which have been the chief hyperextending force, are unbuckled and turned up over the bridge, and the patient remains suspended by the straps running from the bottom of the frame of the bridge. These are closely applied to the front of the chest and shoulders, and permit the upper part of the jacket to be firmly applied around the sternum, upper ribs, and front of the shoulders, holding the chest well back.

If desired, a head-piece may be added to the jacket while the patient lies on the frame, as the neck and head are free, except for the band on which the forehead rests. When the plaster has hardened the webbing strips are unbuckled and the patient is removed from the frame. The webbing strips are easily pulled out from under the jacket and are used again. The band which runs over the top of the jacket is incorporated and its ends cut off near the plaster.

LATERAL DEVIATION OF THE SPINE.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

THREE cases of lateral deviation of the spine of obscure origin recently came under my notice which illustrate very well the puzzling nature of this symptom and the liability there is at times of failing to recognize its cause.

CASE I. was in a boy aged four years, of excellent family history. He had had measles and, a year before applying, scarlet fever. He had never been a strong child. The trouble for which he was brought dated back about six months. His parents said he seemed to get tired easily and assumed a peculiar gait in walking. This became so marked that he was taken to a hospital for a month; but they seemed there to be unable to make a diagnosis, and he then came under my care. On examination he was plump and apparently healthy, but there was a marked deviation of the body toward the right side. (See Fig. 1.) His movements were perfectly free, but not very active. He bent his body readily in all directions, appeared to suffer no pain, did not spread his arms in walking, assume any peculiar attitude in stooping, or act in any way to lead one to suppose that he suffered discomfort on movement. An examination of the back showed apparent perfect mobility with absolutely no projection of any spinous process which would cause one to diagnose caries. There was a double lateral curve most marked in the lumbar region, the convexity of the lower being to the left and the upper to the right. On placing him on his back the deviation disappeared, and a careful examination was made of the abdomen. No evidence of psoas or other abscess or any indication

of tumor or other abnormality could be discovered. Neither did his temperature give us any clue. It being impossible to admit him to the hospital at that time, a spinal jacket was ordered and he was treated as an out-patient. Notwithstanding the lack of any localizing symptoms, the marked spinal devia-

Fig. 1.

tion, together with a history of becoming tired, led us to suspect that the case was one of caries of the vertebræ. He was admitted later to the hospital and the typical symptoms of tuberculous bone disease began to develop. He was restless in sleep, had night-cries, and his temperature rose to 101.6° F. He was

treated on the Bradford frame in bed; but after three months he began to complain of pain in the left side, and two months

FIG. 2.

later a large abscess showed above the left crest of the ilium, and was then evacuated by incision.

FIG. 3.

The subsequent course was that common in Pott's disease; the abscess healed after many months, and it was not until over a year after his entrance into the hospital that any projection of the vertebral spines was noticed. There then developed a slight prominence of the lower lumbar spines, which completed the signs pathognomonic of Pott's disease of the spine. (See Fig. 2.)

Case II. was likewise in a four-year old boy. At the age of two years he had an attack of paralysis, since which time he had some difficulty in walking. For a year he was not real well, and for the nine months previous to applying at the hospital had been limping. He was quite active, walked fast, leaning decidedly to the left side, bent his head freely, picked up coins from the floor readily and without hesitancy, and, so far as movements showed, exhibited no evidence of spinal bone disease. The flexibility of the spine was marked, and its deviation was most evident in the upper lumbar region, the convexity being to the right. The dorsal region was straighter than in the previous case. There was evidence of some rotation of the last three dorsal and two upper lumbar vertebræ; but there was no prominence of the spines. (See Fig. 3.)

This case was treated with plaster-of-Paris jackets and ultimately developed a slight hump in the lumbodorsal region.

Case III. was of a boy about ten years of age, who likewise had marked lateral deviation of the spine, which was suspected to be due to caries in the lower dorsal and upper lumbar region. He had no kyphosis and exhibited perfect mobility of the spine. So little discomfort had he that he objected strongly to the application of the plaster jacket, as it restricted his movements in running around, and he finally kept away altogether.

When the spine is affected with caries and kyphosis develops it is liable to be accompanied by a more or less evident lateral deviation. This deviation is rarely so marked as to overshadow or obscure the spinous projection, hence the case is usually recognized at once as one of Pott's disease. Exceptionally,

however, cases like those quoted make their appearance in which the kyphotic element is entirely absent. Their rarity may cause their true nature to be overlooked, even if carious disease is suspected; most of the confirmatory signs and symptoms may be lacking, thus rendering the diagnosis still more difficult. The general practitioner will almost certainly fail to recognize them, and even the specialist may for a time be puzzled. Case I. had been a sickly child and never well, Case II. had been paralyzed (infantile) in the legs two years previously, and these facts tended to obscure the diagnosis.

In the usual form of lateral deviation in Pott's disease we find it to be more or less angular in a lateral as well as in an antero-posterior direction. In the class of cases here described deviation is not so abrupt, but the curves resemble more those seen in scoliosis. Pain is relied on largely in making a diagnosis, but it was lacking in these cases. Rigidity is a symptom on which great stress is laid, yet not one of these had it. The spines appeared perfectly flexible, were readily bent by the patients and examiner in all directions, and rigidity was not seen on stooping to pick up articles from the floor. As regards rotation, as claimed by Bartow, it existed to only a slight extent in Case II. The sign which I think is probably of the greatest value in making a diagnosis is the fact pointed out by Lovett, that the distortion is not a sinuous curvature but a leaning to the side. While the deviation has not the sinuous curvature of marked cases of scoliosis, it still has less pronounced primary and secondary curves; but as to the leaning to the side, there is no question it is most marked. The whole upper portion of the trunk seems to be shoved bodily over to one side. While this condition led me to suspect Pott's disease at the first visit, when I endeavored to confirm my suspicions other evidence was lacking, and it was only by repeated examination and careful investigation that the true nature of the affection was recognized. It is in just such cases as these that exercises may be ordered with the idea of remedying a postural deformity. Owing to the suspicion of caries these cases were treated with support from the first.

CONGENITAL ABSENCE OF THE TIBIA.

By A. J. STEELE, M.D.,
ST. LOUIS.

Last November a female infant, aged nine and one-half months, was brought to me for consultation. I found the following conditions present: Entire absence of the right tibia since birth. The right leg was one and one-quarter inches shorter than the left. The right foot was markedly varus, though well formed. The external malleolus was prominent, the internal malleolus entirely wanting. The head of the fibula was prominent at the outer side of the knee, and was movable with a slight click, as though it struck and seemed to articulate with the outer condyle of the femur, and over it—*i. e.*, the fibular head—there was in the skin an inverted scar. The right femur was perfect and equal in length to the left, the condyles being readily made out. The leg was flexed to ninety degrees, without power of extension by moderate force. I could not make out the patella, yet I believe it was present, undeveloped, and drawn up on the femur.

No other abnormalities existed in any other part of the body, and, so far as could be learned, deformities were not present in other members of the family.

In the way of treatment nothing had been accomplished, though the family physician had done some subcutaneous surgery back of the heel, and had put the foot up in plaster-of-Paris. My own judgment was to straighten the knee and foot and so retain them by plaster-of-Paris bandages or well-padded brace with sole-plate, and so soon as the child was old enough to walk to use crutches with a modified Thomas knee-brace. I certainly should not at present surgically interfere with the

ends of the bones, lest the epiphyseal cartilages be destroyed and the bone growth be arrested.

I speak of this because Albert has proposed an implantation of the upper end of the fibula into the femur between the two condyles, and, in order to fix the ankle-joint, has suggested an arthrodesis between the astragalus and fibula. Bardenhaur successfully split the fibula at its lower end, freshened the lateral surfaces of the astragalus, and implanted the latter in the cleft between the fragments of the fibula.

I very much doubt the weight-bearing possibilities and the general usefulness of limbs thus treated. Far better would it be to amputate the leg below the femoral condyles, bringing the line of flap union—the scar—well around to the back, thus furnishing an admirable stump for a prosthetic apparatus.

Up to the present time no cases of this abnormality—entire absence of the tibia—have been presented to our Association, though Dr. Willard reported[1] a deficiency of the lower end of the tibia. In a case of Dr. Sherman's operated on after the manner of Albert the procedure was unsuccessful. Our fellow member James K. Young ably reported a case in the *American Journal of the Medical Sciences* in 1888, p. 145. Up to that time this anomaly was rare, and even now, while three dozen cases have been reported of defective formation of the tibia, yet in only a small proportion of these was there entire absence of the bone. The tibia is perhaps the most constant bone in the vertebrate skeleton, and varies less from a presumed primitive type among the different mammals than any other bone.

[1] Transactions of American Orthopedic Association, vol. xiii. p. 312.

In the majority of cases of abnormal tibia other defects have additionally been present, frequently of the foot. In Luke Freer's case of absence of the left tibia there was also absence of the right fibula. In Mr. Clutton's case of absence of the right tibia there was present a deformity of the left hand. In several instances the abnormality was found to be double.

Would not all this seem to point to original germ defect as causative?

This abnormality concerns us as orthopedic surgeons, because it is necessarily accompanied by club-foot. Absence of the internal malleolus is certainly to be followed by an inward turning of the foot, and, as one cause of congenital talipes, it is, strange as it may seem, the only one on which all agree.

My case being an infant, it was not convenient at the time it came under observation to obtain a skiagraph; however, I hope to obtain one later.

THE MECHANICAL TREATMENT OF DISLOCATION OF THE PERONEUS LONGUS TENDON.

REPORT OF A CASE, WITH BIBLIOGRAPHY.

By P. HENRY FITZHUGH, M.D.,
NEW YORK.

Miss J. while playing basket-ball felt a sudden snap in her left ankle accompanied by pain and inability to walk on foot. She was helped to bed and an ice-cap applied. Swelling and ecchymosis soon appeared around the external malleolus. Plaster-of-Paris was applied, and the patient was permitted to walk around with crutches. Fourteen days subsequent to the accident I saw the patient in consultation with Dr. H. Seymaur Haughton. There was some effusion around the joint, tenosynovitis of the tendon of the peroneus longus, which was dislocated from its groove and lying over and in front of the external malleolus. It was easily replaced when the foot was in extreme extension, but would immediately dislocate on returning the foot to a position of flexion. It was therefore necessary to devise some sort of apparatus to retain the tendon in its groove. An efficient apparatus was devised, consisting of a crescentic-shaped pad which snugly encircled the postero-inferior surface of the malleolus and firmly pressed against the tendon in its groove, the projecting malleolus preventing the pad slipping forward. The pad was held firmly to the ankle by a silk anklet. This was worn night and day. In addition to this a steel ankle-support was used, with broad steel pad on outer side, to be used when walking. It was so constructed as to throw the foot into slight inversion and prevent lateral motion. About three

weeks subsequent to the accident I satisfied myself, in consultation with Dr. Newton M. Shaffer, that there existed a shortened gastrocnemius muscle, which, unless normally lengthened, would prevent ultimate cure of the patient. I therefore began daily séances of stretching this muscle with the Shaffer antero-posterior traction brace. These stretchings were continued for nearly four weeks. It was now impossible to dislocate the tendon by any movement of the foot, and the patient has resumed her dancing, athletics, and the usual active life of a schoolgirl. I therefore desire to place this case on record as a cure of this usually intractable injury. While dislocation of the tendon of the peroneus longus muscle is not a rare accident, the reported cases in literature are few, the majority of which are here appended. In addition are incorporated two cases in the practice of Dr. Newton M. Shaffer.

A. B., a young man, aged twenty-five years, an athlete of some local repute, while running a race one day dislocated his left peroneal tendon. There was some swelling and pain, with marked disability following the accident.

I saw him in the autumn of 1887, just after the accident, and after three days of rest and cold applications the antero-posterior traction shoe was applied for just seven times, with complete relief. There was no return of the trouble.

C. D., a young lady, aged about twenty years, made a misstep in crossing the street and dislocated her left peroneal tendon. After several weeks of ordinary treatment, complete relief was secured after about two weeks of treatment by the antero-posterior traction shoe. The patient was seen and treated about four years ago.

In all, six patients have been treated in this manner, the results being uniformly successful. In every instance there was a shortened gastrocnemius muscle.

Montezzia (*Institurioni chirurgiche*, 1803, ii., 3, p. 334). The case reported by this author is generally regarded as the earliest on record. Both peroneal tendons (long and short) were dislocated. The patient was a young man who was dancing when

the accident occurred. He felt at the time a sensation over the tendons as if someone had kicked him. After reduction the luxation reappeared as soon as the patinet walked. Montezzia was unable to obtain any permanent reposition of the tendon.

Astley Cooper. Next in order to the preceding may be mentioned a case cited in this author's work on *Fractures and Dislocations*. Miss H. was thrown from a horse and sprained her ankle, with dislocation of the peroneus longus. The use of a compress and bandage held the tendon in place, but relapsed after leaving the hospital.

Robert (*Gaz. des Hôp.*, 1847, 389). A man of fifty-four years of age attempted suicide by jumping from a high place. In addition to a broken thigh, contusions, etc., both peroneal tendons of one leg were luxated. The dislocation was a natural result of rupture of the fibrous sheath from violent muscular action at the time of the fall.

Demarquay (first case, *Bull. Gén. de Thérapeutique*, 1861, p. 21). A man, thirty-five years of age, was thrown from his horse, striking on one foot. Pain and disability resulted. Dislocation of the tendons of the peroneus longus and brevis was recognized. The fibrous sheath had been torn and there was an ecchymosis over the injury. A compress and bandage were applied, and in twenty days the patient was able to walk with a cane.

Demarquay (second case, same reference). A girl, twenty-two years of age, leaped from a window while terrorized, and sustained contusion, etc. Ecchymosis over peroneal tendons, which were found to be dislocated. A compress and bandage were applied, and in a month the patient was able to walk with a little trouble. This case, according to Blanluet, appears to have been one of actual recovery.

Jarjavay (first case, *Gaz. Hebdom.*, 1867, iv., p. 387). Man, age not stated. Fell from chair while standing, and struck upon the anterior portion of the left foot, which was turned inward at the time. There appeared to be no injury at the time, and the patient resumed work. Pain was present over the peroneal tendons, and became worse with progressive swelling, and disability finally resulted; dislocation of the peroneus longus recognized, which could be readily reproduced after reduction.

A starch bandage was worn for a time, after which the dislocation no longer reappeared. A compress and bandage were worn as a precaution.

Jarjavay. Second case (same reference). Male, fifty-five years of age. In leaping from his carriage while the horse was in motion, he struck heavily upon his left foot. Pain and disability resulted. Diagnosis obscure for a time, until a tendon was noted over the external malleolus. After reposition and bandaging there was no further displacement when patient walked. He used crutches for a short time.

Jarjavay. Third case (same reference). Male, aged forty-four years. Fell from a height of over thirty feet. Examination about the foot and ankle upon which he struck showed evidence of dislocation of the peroneus longus. A compress and bandage were worn for several days, followed by the application of a starch bandage. After this was removed patient walked for a time with crutches, and then without aid of any sort. No mention of any recurrence or disability.

Blanluet. "De la luxation des tendons des muscles peroniers lateraux." *Thèse de Paris*, 1875. (This is the principal monograph on the subject in question.) Male, age not stated. Had a fall from a height and struck upon his right foot, which was turned inward at the time. Experienced sharp pain over ankle, which continued and was followed by disability. After complete examination the diagnosis of luxated tendon of peroneus longus and brevis was assured. Despite all efforts, permanent reduction could not be obtained until the parts had been immobilized and patient kept for some time in bed.

Broca (*Bull. Acad. de Méd.*, Paris, 1874). Case of an aeronaut who dislocated the tendon of the peroneus longus while stepping from a balloon. Case discussed fully by members of Academy.

Curling's case (reported in *British Medical Journal*, January 2, 1869). Male, aged twenty-one years, turned his ankle on a stone. Found a projecting cord over the external malleolus and easily reduced it. Luxation returned at intervals. A surgeon applied a pad and bandage. When Curling saw him he had a laced anklet made, which kept the tendon in place. There was a sense of weakness in walking over rough ground.

Bryant's case. In Bryant's *Surgery*. Woman, aged twenty-nine years, dislocation supervened while patient was walking, and disabled her. Readily reduced, but returned whenever foot was abducted. Treated with pad and strap, with good results. No mention of final outcome.

Beach, H. H. A. Surgical Cases (*Boston Medical and Surgical Journal*, March 2, 1876). Young woman; experienced the accident while out walking. On reaching home found something on outer side of ankle which could be moved in and out of place without pain. Did not consult author until several weeks later. He found that the tendon of the peroneus longus could be easily displaced forward from its groove upon the malleolus. The chief disability encountered was in going down stairs; she was then likely to be thrown forward with great risk. The accident doubtless originated in an ordinary sprain. It was practically incurable, although it could be controlled by a pad.

Hodge (personal communication to Beach; see preceding). Lady, aged twenty-two years, sprained her ankle and went about too soon afterward. Plaster bandage applied, and when removed a few weeks later, patient seemed to have fully recovered. Soon afterward she fell again and got a new sprain, and Hodge then found that the peroneus longus had been dislocated. Going down stairs would throw the tendon out of its groove, despite retentive apparatus. Finally, a boot designed to prevent flexion of the foot gave a relative amount of immunity.

This lesion always occurs during a muscular effort with the foot everted and flexed. While this is the direct cause the indirect is a shortened gastrocnemius and peroneal muscles. With these muscles of normal length the full play of the ankle-joint, even in traumatism would not dislocate these tendons from their groove. In the study of the few reported cases one is struck with the fact that few or none of them were permanently cured. While it was easy enough to replace the tendons, and to hold them with some restraining apparatus, a removal of this was immediately followed by reproduction of the dislocation. In the case I here report this shortening (the suggestion of which I owe to Dr. Shaffer) was easily recognized, and the cure was undoubtedly due to correction of this fault.

THE TREATMENT OF SOME OF THE PARALYTIC DEFORMITIES OF THE LOWER EXTREMITIES.

By G. A. WRIGHT, M.B. Oxon., F.R.C.S.,
MANCHESTER, ENGLAND

Infantile paralysis supplies most of the cases of paralytic deformity with which we have to deal. I propose only to state shortly my own practice in treating this and one or two other conditions.

The first point to consider is, of course, the extent and completeness of the loss of power. If there is merely a weakness of the peronei or extensors, my custom is to apply an "artificial muscle" in such a way as to slightly overcorrect the deformity when the elastic cord is at rest; the rubber is applied usually so as to pull in the direction of the weak muscles, but it may be sufficient to use one cord only, even when both extensors and peronei are damaged. The play of the elastic not only corrects the deformity, but constantly exercises and tends therefore to strengthen the affected parts. In cases where secondary contractures have occurred and in cases where the deformity is due to spastic paralysis, if the rigidity is slight a "muscle" applied in a suitable direction is used, while in more severe cases a preliminary tenotomy is done. As a rule, considerable improvement can be obtained in spastic paralysis by tenotomy and the use of "artificial muscles;" but I have met with a case of great severity associated with severe "cramps," in which neither tenotomy nor splints enabled us to even apply "muscles."

If the paralysis is of the posterior and flexor group, leading to paralytic flat-foot, the "muscle" is applied on the inner side

as for ordinary flat-foot, or in very slight cases I merely raise the inner side of the sole and heel of the boot.

In the next more severe stage of paralysis I have been very favorably impressed with the results of tendon grafting, and, though I have not done any large number, I have found it most useful, and certainly propose to employ it further. Its use is, of course, limited almost entirely to conditions where several muscles remain good and can be utilized to replace the weak ones. I need not go into the technique of the operation, which will vary in different cases and in the hands of different operators. Each case has to be planned out according to the precise form and degree of paralysis.

In some instances where no good muscles are available for grafting it is worth while to employ shortening of some of the tendons to try to improve the most pronounced part of the deformity, though success is doubtful. This plan is of value occasionally in overstretched and, therefore, powerless muscles.

Where there is complete paralysis of all the leg muscles below the knee, resulting in a flail-foot, but the limb is good in its upper part, I prefer arthrodesis of the ankle, either removing the astragalus, or, better, paring off the cartilage from it and the tibia and fixing the bare bony surfaces in apposition. The extensor tendons may, if desired, be shortened at the same time, either by excision of a portion and reunion, or by "pleating."

If the paralysis is more complete and involves the quadriceps, leaving the knee-joint useless, I perform arthrodesis of the knee, with or without the same operation on the ankle. My first arthrodesis was done in 1884, and I have employed it regularly in suitable cases since.

If there is a doubt as to the power of the iliopsoas and the usefulness of the limb, I sometimes test the case by making the patient wear a Thomas knee-splint to walk with, and if he can manage to get along with this he will probably be improved by arthrodesis. In some cases the permanent use of the splint is required instead of arthrodesis; for example, where operation is refused or is from any cause undesirable; and in any case it should be worn after operation for a year or two, until the union is quite firm. It is worth while to try a knee-splint made

of the proper length for walking in cases where the paralysis involves the whole limb so completely that no power of carrying the limb forward exists. This brings us to the last degree of the paralysis, where the complete loss of muscular power is associated with such failure of nutrition that ulcers and the suffering from cold make the limb a burden. Only in such cases must amputation be considered; happily this residuum is a small one.

My practice ranges, then, from the use of artificial muscles through tendon shortening and tendon grafting to arthrodesis, then in a few cases to the permanent use of a Thomas knee-splint, and, finally, very rarely to amputation. I never use irons or complicated apparatus either to correct deformities or to hold paralytic limbs in position, my objections to them being their weight, cost, complexity, and inefficiency, though I am not prepared to say that others do not make good use of them. My present object is merely to indicate the line of practice I follow myself and find fairly satisfactory.

THE CAUSE AND PREVENTION OF DEFORMITY AND DISABILITY IN TUBERCULOSIS.

By A. B. JUDSON, M.D.,
NEW YORK.

The vestiges of tubercular action in and about a joint are found in loss of bone and cartilage, changes in articular surfaces, shortening of ligaments, and the presence of cicatricial tissue. Lessened in their extent and severity by whatever mitigates the morbid action, they give rise to deformity and disability. For the purpose of more particular inquiry hip disease may be taken as furnishing typical results of the tuberculosis of joints. And here it may be well to say that deformity by itself, or uncombined with arrest of motion, is not of very serious import. Destruction of the femoral neck certainly deforms by elevating the trochanter and shortening the limb; but, with this asymmetry, if the limbs could be laid parallel and at right angles with the pelvis, the deformity would not be extremely serious. Now adduct and flex the thigh and abolish motion, and then bring the limbs parallel and flat on the table, and we witness as the results of bad position and want of motion, a great increase of shortening, elevation of the pelvis on the affected side and a spinal deformity composed of lateral curvature and lordosis. These phenomena, evident in the supine patient, are still more so when the patient stands, and when he walks the result is a truly remarkable gait, due to absence of motion in the joint and bad position of the limb, which combine to produce the trouble which we are considering.

There is not much to be said as to the prevention of limited motion in the joint. Caused by cicatricial tissue and the other results of inflammation, it may be controlled by whatever

shortens the disease. I have seen no good results following brisement forcé or incisions, open or subcutaneous, as applied to this joint. When it comes, however, to preventing a bad position of the limb there is much to be said and done. Many causes of bad position have been assigned, but the true one is found in the observation that the limb takes that position in which the diseased joint gives to the patient the least pain and the greatest convenience in his habitual attitudes and actions. In standing the body rests chiefly on the well limb, and in the abduction of the affected limb we have an early sign of incipient disease. When pain on motion sets in, the limb is adducted and brought in contact with its fellow for assistance in fixation. When more urgent symptoms bring the patient to recumbency fixation is sought in an attitude in which the thigh is extremely flexed and adducted and pressed in contact with the trunk. In time flexion and adduction become established, and during those long periods in which the patient is free from pain and active on his feet they are seen to contribute to comfort and convenience in locomotion. When the patient walks the limb in this position avoids the ground, where it would take too much of the weight of the body and be exposed to painful contact with obstacles. The affected limb being thus withdrawn from service, the well one pushes forward to do vastly more than its proper one-half share of the labor of progression.

The cause of bad position being thus discovered in the instinctive or unconscious efforts of the patient to avoid pain and gain convenience, obviously its prevention is to be sought in whatever adds to the patient's freedom from pain and convenience when walking. Nothing better has been found for this than the ischiatic crutch, which is a support applied, not to the axillary, but to the perineal region, preferably called ischiatic, because it deals with the bony and not the cutaneous and cellular tissues. With a high sole on the well foot and this crutch correspondingly long, the limb is pendent above the danger of meeting impediments and exempt from weight-bearing and the work of locomotion. Taylor's long hip-splint, which makes provision for adhesive plaster prehension and traction, essential day and night in acute stages, is an ischiatic

crutch and gives the same protection and exemption as the simpler apparatus, which is removable at night, and may be properly in use until advanced convalescence.

Thus equipped the patient might be expected very soon to give up adduction and flexion; but this result does not follow, for two reasons: (1) Because the joint has become more or less stiffened in position, and (2) because the patient has acquired the bad habit of walking in false rhythm, expressed thus: one, two—one, two—one, two—one, two—one, two—one, two. He must, therefore, be taught to observe the normal rhythm of human locomotion, which is extremely simple and may be expressed thus: one—two—one—two—one—two—one—two—one—two—one—two—one—two. The acquisition of the bad habit has been the result of unconscious efforts to relieve the affected limb and to throw extra work on the well foot, which shoots forward and strikes the ground sharply and lingers an undue time supporting the weight of the body. This is done, of course, to protect the affected joint from weight-bearing, concussion, and pain. But with the steel crutch in place, protection is complete, and habit alone is responsible for a continued departure from normal rhythm. It follows, then, that the patient must by instruction and drill be induced to observe a natural, and not lame, mode of walking. Lameness is but a departure from symmetrical walking, as deformity is asymmetry of shape. In evidence, let the reader lay aside the book and pace the room a few times, observing in his footsteps first true and afterward false rhythm, and he will be convinced that the latter changes a normal to a defective gait—in other words, produces lameness. Or let him induce a patient lame from hip disease to change his customary violation of rhythm for a mode of walking in which the two feet beat correct time, and the diminution of lameness will be obvious. From this may be educed a precept of practical value to those who are lame, from whatever cause, and if the lameness coincides with or follows hip disease a lessening of adduction and flexion will be the result, if the joint is not irrevocably stiffened. Throughout those stages in which active treatment is maintained the joint is so tractable that the usual bad position is materially reduced. A

number of cases have been reported in which this good result has been seen.

It remains to consider the methods by which the changes from false to true rhythm may be brought about. To one who undertakes the task with a given patient it will at once be evident that it must be an educative process composed of instruction and drill, not unlike the training of a military recruit, but more difficult, as many patients are "spoiled children" and excusably wilful. A great advantage will fall to the lot of those who treat groups of children as is done in charitable institutions. There the work of a competent instructor would be carried on with appropriate music and competitive drills. It should not be considered out of place to teach these children a graceful and symmetrical manner of walking. If the sound and healthy are benefited by military drill and instruction in dancing, it is still more important that our patients should have these advantages, and this would be true even if it did not lead to a better position of the limb.

A great deal can be accomplished, however, with individual patients in private practice. Regular exercises should be enforced, and care taken that the footsteps are correctly measured and timed. The method is uniformly successful with children who are docile and under good management at home. It is a curious fact that girls and young women who study the art of appearing well recover with comparatively little deformity, an observation which, with others, led up to these views, expressed in 1887,[1] and confirmed by experience.

[1] Lancet, December 22, 1888, p. 1227.

THE MECHANICAL TREATMENT OF SPASMODIC WRYNECK.

By GEORGE R. ELLIOTT, M.D.,
NEW YORK.

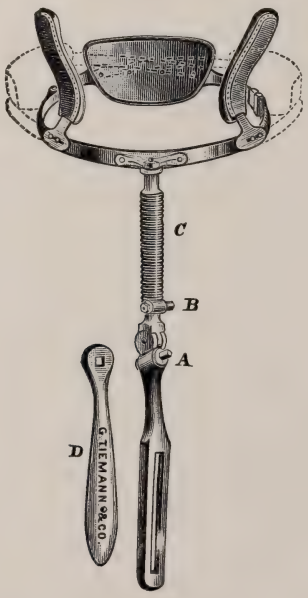
The form of wryneck referred to in this paper is purely a nervous disease, and not the type usually seen by the orthopedic surgeon.

Some patients are cured by the neurologist. A larger number seek one neurologist after another without any permanent relief. After consuming large quantities of atropine, gelsemium, conium —the latter pushed almost to the Socratic limit—the patient is stretched, galvanized, faradized, massaged, hypnotized. She is advised to take a course of hydrotherapy. Finding little or no relief from the regular physicians, she becomes willing to consult the Philistine rank. Hearing that Mark Twain or Thomas Platt were successfully treated by the osteopath for some age-end nervous affection which had baffled the regulars, she is pummelled by the bone manipulators daily for three months, and at the end is rather worse. She does not even escape the Faith Curists and the Christian Scientists. As said above, this form of wryneck is purely of a nervous type. It is characterized by spasm of the muscles supplied by the spinal accessory, and sometimes by the upper cervical nerves. The patient is usually of a neuropathic constitution, and heredity often plays its part. A clonic and intermittent spasm, with pain in the neck, characterizes the disease. The sternomastoid and trapezius muscles are the ones usually involved. The head is inclined to the affected side by the trapezius, the chin is raised, and the head rotated to the opposite side by the sternomastoid and trapezius. The neuromechanism is irregular and the spasm

intermittent. These patients have not done well, as a rule, in the hands of the general surgeon. Many failures follow nerve resection and muscle cutting, and the second state is often worse than the first. If we cannot always cure, how can we add to our patient's comfort? Apparatus devised for these patients is of the fixed type, and the patient finds it so burdensome that it is usually cast aside.

Rigid appliances are discarded because the patient finds it absolutely impossible to have the head held in any one position;

Fig. 1.

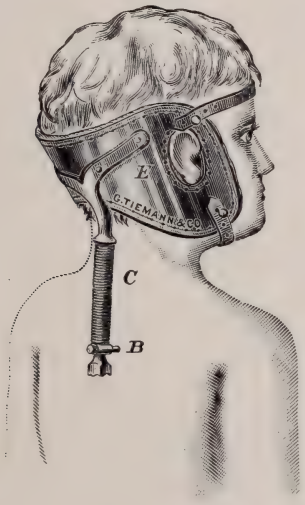


their nervous make-up demands freedom. To be held as in a vise increases the discomfort.

The apparatus which I have devised is based upon the principle of allowing necessary support without absolutely restricting any normal movement of the head. The first case with which it was employed with success was in a patient—a woman, aged forty-two years—referred to me by Dr. C. L. Dana, in June, 1898. She had been afflicted with the disease for one and a half years, and had been under the treatment of several nerve

specialists before she consulted Dr. Dana. Careful and skilful medical treatment had failed to cure her. The muscles affected were the right sternomastoid and trapezius and the head rotated to the left side. This was accompanied with considerable pain. By supporting her chin with her hand and using a slight amount of force she could readily bring her chin back to its regular position, and as long as she supported it gently she felt comfortable. As soon as she removed her hand the spasm returned after a few moments, and the head gradually rotated to the left side. The force of the spasm had gradually increased.

Fig. 2.



She said more force was required to hold her chin than six months previously. In devising an appliance for her, the object sought was to get just the amount of force necessary to do just what she could do with her hand and allow her all the natural movements of the neck, for rest to her meant freedom to move her head to any position she desired. Holding it fixedly, even with the hand in one position, soon became very irksome and gradually painful.

The apparatus was made for me by Tiemann & Co., and is shown in Fig. 1. The chin-piece is the usual one of Dr. Taylor,

with hard-rubber chin-cup and two uprights holding back of head. The chin-piece is readily removable. It is secured to an upright over which is coiled at *C* the spiral rotating spring of Doyle.

Below the spring rod is an Archimedean transverse screw which is worked by a key. By means of this any degree of rotation is produced. A little distance below is another Archimedean screw, also worked by a key, giving flexion and extension.

The lower section of the rod is slotted and can be attached to any brace or corset by two screws, the long slot permitting raising or lowering of the headgear. The apparatus is then in every way adjustable. What is claimed especially in this appliance as original is the ability to get rotation as well as the other normal movements of the head, under absolute control, and especially rotation without fixation.

In case the spasm to be overcome is so great that dislocation of the maxilla is feared, or pressure is disagreeable, the so-called Minerva head-piece, as shown in Fig. 2, can be substituted. This has been successfully employed in just such a case.

AN OPERATION FOR FLAIL ELBOW.

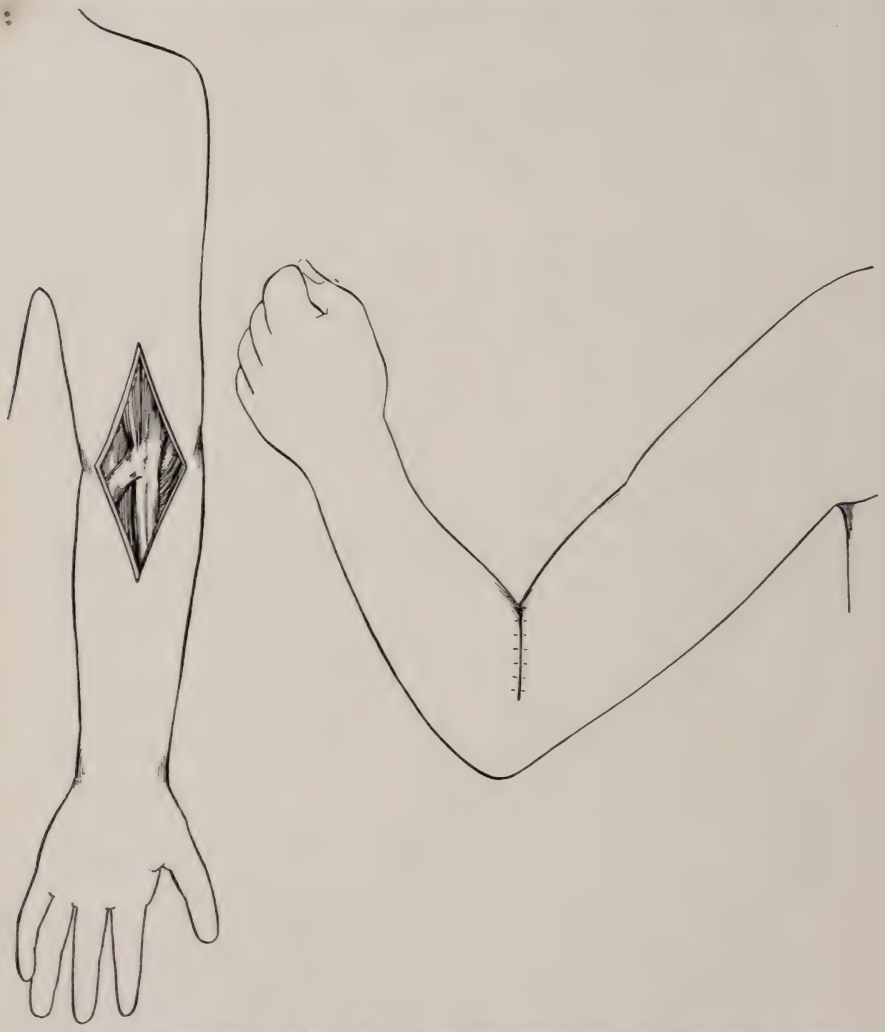
By ROBERT JONES, F.R.C.S.,
LIVERPOOL, ENGLAND.

It is not very uncommon in poliomyelitis to meet with a flail shoulder and elbow and a hand possessed of voluntary movement. In some instances the muscles of the shoulder girdle are wholly, in others only partially, paralyzed, while the biceps and brachialis anticus are functionless. The hand in such a case is of little use so long as the arm lies limp in full extension, and the surgeon has therefore to devise an appropriate apparatus to keep the elbow flexed, or an operation which will render mechanical aid uncalled for.

I have now treated seven such cases by a simple procedure whereby one can fix the elbow at any angle that is desired. The angle usually deemed most serviceable is that of about forty degrees, as the hand in this position can usually reach the neck and mouth. The operation consists in dissecting away the skin covering the front of the elbow and attaching the forearm to the upper arm. The quantity of the skin to be removed will vary, but it should be ample to allow the elbow to be firmly fixed at the required angle. I have found the removal of a diamond-shaped piece of skin to be thoroughly effective and more convenient than any other form of exsection.

The technique merely consists in taking surgical precautions and in removing the same quantity of skin from above the elbow as from below. As the diagram shows, the diamond-shaped wound is divided into two triangles by the flexure of the elbow. While the arm is extended sutures are passed from the apex of the upper triangle to the apex of the lower, and so from the sides of one triangle to the sides of the other. The several sutures are grasped by forceps, and the elbow is flexed when each suture is tied and cut. The operation will only last

a few minutes. In three of my seven cases, operated upon over twelve months ago, some degree of voluntary flexion has



NOTE.—Exsection of skin should be more extensive, and flexion of arm more acute.

returned. This is due to strength having been acquired by overstretched muscles placed in favorable physiological and mechanical position.

AN EXTREME CASE OF COXA VARA.

By ROBERT JONES, F.R.C.S.,
LIVERPOOL, ENGLAND.

I HAVE the honor of offering you a short account of coxa vara in a woman twenty-six years of age, which has the two-fold interest of having run a prolonged course and of presenting extreme changes in the femoral necks. She walked into the out-patient department with a shifting gait, suggestive of both congenital dislocation of the hip and spastic paraplegia. Her knees scraped, but her toes were not inturned.

She complained of considerable pain in the hips, more especially on movement, and she could only walk a few hundred yards without feeling prostrated. Within the last few months pain was more frequent and discomfort constant. Both hips were prominent and lordosis marked.

The mother informed us that she began to walk when two years old, and from that time on a wobble was noticed. When eleven years old she was treated for hip disease, and for eleven months she wore a Thomas hip splint on the left limb.

On examining the patient it is found that:

The right trochanter is two inches above Nélaton's line, the left two and one-half inches.

The length of the limbs measured from the umbilicus is equal.

The measurement from the anterior spine to heel gives the right limb half an inch over the left.

The flexion angle on either side is sixty degrees. Neither limb can be flexed onto the abdomen beyond a right angle.

Abduction of either limb is very slight. The tip of the internal condyle can be abducted from the middle line two and one-half inches, the left two inches.

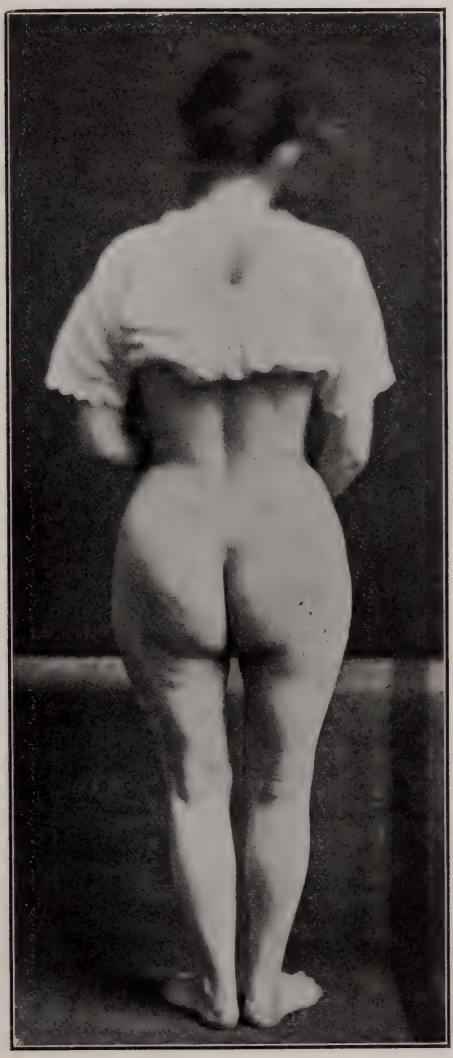
Adduction is more free. The limbs can be adducted so that the under surface of either knee can rest on the opposite patella.

Fig. 1.

This is the position most comfortable to the patient, first one limb on the top, and then the other.

Both limbs are in a position of slight external rotation. They can be rotated outward through an eighth of a circle, but inward

Fig. 2.



only to a position in which the patella looks directly forward. The patient was late in getting her teeth, but there are no other

signs of rickets. She was breast-fed. I brought her to my house, where Dr. Morgan skiagraphed the hips. The picture

Fig. 3.

most admirably depicts coxa vara more extreme than I have ever seen it illustrated.

The head of each femur is opposite the acetabulum, and the neck forms an acute angle to the shaft. The trochanters are not thickened. Three and a half inches from the top of the trochanter the lower border of the femoral head on the left side is within a quarter of an inch of the shaft. Part of the rounded head is excurvated out of the acetabulum toward the femoral shaft. The neck is irregular and somewhat narrowed in contact with the head. The upper border of the left neck measures three and a half inches, the lower three-quarters of an inch. On the right side the head practically touches the shaft four and one-half inches from the top of the trochanter. The superior border of the neck is four and one-half inches in length, the lower one and one-quarter inches. The same kind of irregularity is noted, and the neck is very thin toward the femoral head. The head seems also to be levered out of the joint, the rounded head being enlarged, its lowest portion reaching three-quarters of an inch below the acetabulum. The skiagraph distinctly explains the very marked limitation in movement.

The patient is at the present time under treatment, having been placed in a double abduction splint while under an anæsthetic. The knees, which could not be separated voluntarily more than five inches, are now twenty-six inches apart, and I purpose keeping the hip-joints at rest for at least three months.

THE SURGICAL TREATMENT OF CEREBRAL DIPLEGIA AND PARAPLEGIA.

By ROBERT JONES, F.R.C.S.,
LIVERPOOL, ENGLAND.

For many years I have been much interested in the treatment of spastic paralysis, a disease which, in England, has generally gravitated into the hands of the physician, who has utterly failed to make any impression upon its course. Indeed, it is only quite recently that our surgeons, for the most part timidly, have attempted to grapple with the affection. In America more serious and consecutive work has been done, and it is only because of the interest evinced in my results by Americans who have honored me with a visit that I am sufficiently bold to contribute the methods I adopt to the Transactions of the Orthopedic Association.

I shall pass over without a word the etiological and pathological factors appertaining to the affection and deal merely with points of clinical interest. It must be left to the surgeon to decide upon the degree of intelligence a patient is possessed of, and whether the degree possessed renders it worth his while to proceed with treatment. I would argue that a large proportion of children suffering from severe spastic paralysis may be transformed into useful members of the community, improved both in body and mind by surgical methods, enabled to walk with comparatively little deformity, many requiring only the aid to be derived from one or two sticks.

The class of case which we can place outside remedial art is the idiot, the microcephalic, and that violent irritable type of diplegic, so often seen, subject to fits and active athetotic movements, who has generally lost all control over his secretions.

The treatment of any condition short of this may be undertaken with varying success, subject to conditions which obtain in any surgical case requiring prolonged attention. For instance, active treatment may be needed for nearly two years. It would, therefore, be unwise to admit a case into a hospital for two months and then send it to a miserable home where neglect would be the inevitable sequence. Such a case, however, after hospital treatment, secure in the care of anxious, intelligent parents, no matter how poor, would prove a credit to all concerned. These are important matters which the surgeon must consider before he undertakes his work. Another class which gives the greatest anxiety and trouble is that where the affection of the hands is of such a kind as to promise but slight hope of their assistance to the limbs during walking. Before despairing, however, I think it is well to give such hands the opportunity of a careful trial, both as a mental discipline and because success sometimes exceeds expectation.

I would divide the treatment of all cases of spastic paralysis into operative and post-operative, for, although mechanism is involved in nearly every case, there is hardly a case which we are called upon to treat without invoking operative aid.

Infantile hemiplegia usually affects the arm much more than it does the leg. This is almost invariably the case, and in this particular it differs from diplegia, where, when the four limbs are attacked, the hands are frequently less severely affected than the limbs. Indeed, in hemiplegia the paralysis of the hand is sometimes absolute, and, in addition, we have a complication in the shape of rigidity. The behavior of the lower limbs differs also from that of spastic paraplegia, in that the adductor spasm is proportionately not so marked.

The treatment of the hand and arm in infantile hemiplegia is distinctly less promising than in the diplegic case; but there are clinical signs to which I would draw your attention which help us to prognose success or failure. If the paralysis is complete, or, in other words, if the little patient is never known to relax his spasm, treatment is futile. If he only moves the fingers of his affected hand in conjunction with the fingers of the opposite side, the results will, in all probability, be discour-

aging. In all cases where the parents are able to say in the spirit of true observers that the patient is able to do more with the hand now than a little while ago the success of treatment is assured. Similarly, where any degree of voluntary relaxation of spasm exists, apart from an associated movement on the opposite side, treatment is emphatically indicated.

Noting that the dominant deformity in both hand and elbow is pronation and carpal flexion, treatment should consist in fixing the elbow supine and in hyperextending the wrist. The hyperextension of the wrist should be combined with that of the fingers, and a special arrangement adapted to keep the thumb at right angles to the palm. The spasm in these cases is often so pronounced that the extension of the wrist and fingers must be brought about very gradually. If the elbow is accompanied by contracture of the biceps and brachialis anticus supination may be combined with extension. If this be not the case the flexed position of the elbow will suffice. If instead of being firmly pronated, the elbow lies semiproned, it is not necessary to treat it, and all one's energies should be directed to the hand.

It is difficult to give a reason as to how improvement comes about; but it may be taken as an axiom that prolonged fixation of the spastic muscles in a position opposed to their contraction lessens the severity of the spasm. This is true wherever spasm may be found, and its influence may be tested even in spasmodic torticollis, intractable as we know that affection to be. It would appear as if the group of muscles at last get tired of trying to pull. If the case be mild this treatment may be discarded in about twelve months, if during the whole of that period the extension has been kept up without intermission. The test for relaxation must be the power of voluntary movement, however slow it may be. It will be noted that generally at this stage the patient, in endeavoring to extend his wrist, will first of all close his fingers and will only open them on completion of extension. The process is reversed when the wrist is flexed. In order to meet this difficulty the splint employed to extend both wrist and fingers is modified so as to extend the wrist alone and allow freedom to the fingers. At this stage or

earlier the surgeon may decide whether in a given case success may be predicted, and, if he is in doubt, operation should unhesitatingly be performed. Operation will consist of tenotomy or tendon transplantation; myotomy need only be mentioned to be avoided. An incision is made over the tendon of the flexor carpi ulnaris just above the annular ligament; another is made over the flexor carpi radialis, and both tendons are divided low down and taken, (*a*) the flexor ulnaris to be inserted into the extensor ulnaris, and (*b*) the radial flexor into the radial extensor. I performed this operation some years ago upon two spastic children—whom I showed before the Society for the Study of Disease in Children—and in both instances voluntary movements were steadily performed, and one, a girl of nine years of age, was able to write quite a respectable hand. At the present time one of the worst cases of athetosis in connection with cerebral diplegia is an inmate of the Liverpool Country Hospital for Chronic Diseases of Children. When he entered the hospital, nearly two years ago, both limbs were firmly adducted, and contracture had occurred, which had so affected the feet that plantar flexion had taken place with almost evulsion of each astragalus and cuboid, the skin of each dorsum being reddened from pressure from within. The hands were firmly flexed and but little voluntary movement existed. Athetotic movements, more resembling chorea, with occasional jerks which almost lifted the patient from his bed, complicated treatment. So far as the hands were concerned, hyperextension such as I have described was practised, and later division of the flexors of the wrist. The little patient has steadily progressed. He can voluntarily move his limbs in all directions; with aid he can take a few strides. In order to overcome severe spasmodic pronation of the forearm, Mr. Tubby has changed the point of insertion from the front to the back of the radius of the pronator radii teres, thus transforming the muscle into a supinator. So far this operation has been performed seven times by him, and I intend practising it on a series of cases during the summer.

Tenotomy alone has proved distinctly disappointing, although one has had an occasional successful case. The operation should be confined to the division of the flexor carpi radialis and ulnaris.

It is, in my opinion, better to elongate the other flexors of the hand by a long median incision such as one would employ in lengthening the tendo Achillis. Tendon transplantation, however, is a better operation, less complicated and more reliable. The surgeon's art, however, does not end with the operation, and hyperextension of the wrist, leaving the fingers free, should be practised for a further few weeks. In order to prevent adhesions after the operation the wrist should be freely but withal very gently moved in about a fortnight's time. Whether an operation has been performed or not the final stages of treatment are identical. They should consist in getting both guardian and patient to strive every nerve to urge and practice movements from simple to complex. The surgeon must inspire confidence and instil enthusiasm.

The nature of the movements to be practised must be left to the ingenuity of the surgeon. The principle which should govern him may, however, be here indicated:

a. The movements should be practised slowly and without excitement.

b. They should be made interesting to the child.

c. Those opposed to the direction of deformity should predominate.

d. Those presenting the greatest difficulty should be chiefly practised.

Just a word, before we deal with paraplegia, regarding tenotomy of the spastic muscle. Empiricism has taught us that for some reason or another tenotomy lessens both in frequency and in intensity the spasmodic element in paraplegia. I do not merely mean to say that division of the tendo Achillis controls spasm in the calf muscles, although of course it does, but rather that spasm in which those muscles are not directly concerned is also influenced. This is beyond all question, and must have been noted by everybody who has had the opportunity of observing, and the fact has now reached the robust stage when physiological explanations are vouchsafed.

Whitman urges that by elongation of the tendon the response to the exaggerated motor impulses is lessened and an opportunity for more effective control is afforded.

Discussing the question with Mr. Tubby, he propounded the theory that once the immediate pathological effect of the central nervous lesion has subsided the spinal cord remains in a state of undue reflex excitability. A tightly contracted muscle and tendon tend to augment this condition and so induce in themselves further contractions. In other words, there is a vicious circle of reflex action which can be interrupted by section of the tendon and diminution in the tension of the affected muscle and tendon.

Lorenz attributes the good effect to the shortening of the bellies of the tenotomized muscles, so that their range of action is diminished. Both these theories refer, of course, to spasm with which the divided muscle is concerned, and do not explain the diminution in spasm experienced elsewhere. We must further remember that the opponents of contracted muscles are always elongated and weak, and that the rest afforded them by tenotomies, by relieving them of strain, helps to restore muscular equilibrium.

The practical deduction from these observations is that no opportunity should be lost of performing a tenotomy. Even in mild cases where a spastic tendon is to be felt let us ruthlessly divide it. If the surgeon has decided that a case of spastic paraplegia is suitable for treatment a splint should be prepared so designed as to keep the limbs in pronounced abduction, the area over the hamstrings, the adductors at the groin, and the tendo Achillis should be suitably prepared for operation. The adductors should be first attacked. An incision an inch and a half long should be made to the inside of the adductor longus. This muscle should be seized by a Spencer Wells or small Doyen forceps and about three-quarters of an inch of it removed. The limb is then abducted and portions of the adductor brevis and gracilis are exsected in similar fashion. The horizontal portion of the adductor magnus and, if necessary, the pectineus, is divided, and also any tissue, muscular or fibrous, obstructive to an absolutely free abduction of the femur. Experience has shown me that although the chief offenders are the adductors longus and brevis, nevertheless the deeper muscles often require division. To anyone who has practised the

operation the futility of attempts to effectively divide the muscles subcutaneously will be apparent. Division is followed by but little hemorrhage, and the wounds are closed without drainage. Having exsected the pieces of the adductors, each tendo Achillis is divided subcutaneously and rectangular splints are applied to the foot. The limbs are then well abducted and the surgeon notes whether there is any obstacle to easy extension of the knees. If there should be (it is not often the case), an open incision must be made on each side of the popliteal space, and the tense hamstrings are in turn divided. If these incisions are long enough the fascial contraction can be attacked on either side, for it is here that opposition is often found. I would discourage the use of a transverse incision, as, when adopted, it often seriously hampers the surgeon's efforts to fully extend the knee by reason of the strain cast upon the sutures. In 1885, when I was at the Stanley Hospital, there used to be an adult diplegic in a perambulator always at the gates, and on two or three occasions I took him in to try and straighten his contracted limbs. On one occasion I removed about an inch from each of the hamstrings; but he was mentally so deranged that we did not do each other any credit. I mention the fact, however, because Lorenz, of Vienna, has quite recently written on the advantage of exsecting portions of the hamstrings.

We have now presumably got our patient comfortably stretched upon an abduction frame, and we must keep him there for three months. The wounds heal very rapidly, and suppuration has occurred in the adductor cavity on three occasions only, despite the insanitary position of the wounds and the number of operations performed; for instance, in 1890 I operated on twenty-seven patients, and this may be taken as a fair index of my yearly return.

At the end of three months the splint is taken off during the day and movements are sedulously practised. For some weeks stiffness exists, and often the movements are at first painful; but after a time, always shortened by vigorous exercise, the pain disappears and the effort must be made to walk.

The splints are of a simple kind, designed to keep the knee

from bending. The boots should be made of felt, with substantial soles. The nurse should be instructed to keep both boots and splints upon the patient day and night, and, for the first two weeks, frequently during the day, abduction, adduction, flexion, and extension of the hip should be practised. This should be done with and without resistance. At night-time the feet should be attached to the side of the bed, in order to maintain abduction. After the first few days of this later stage of treatment the splints should be removed twice a day and the muscles well massaged, and both active and passive movements of the ankles, toes, knees, and hips encouraged. Any movement executed in a jerky style should be practised until perfected.

The little patient may now try to walk. It will be noted that one of the difficulties of an untreated spastic when he tries to walk is the narrowing of the pedestal upon which the trunk rests, by reason of adducted limbs. Operation has now overcome this, and with abducted limbs the body is poised upon a widened pedestal. During early training the nurse must see that while walking the limbs are not approximate, and that from the first swinging of the limbs must be prohibited. Crutches should not be allowed until the patient has been taught to stand unsupported. I need not enter into any more detail regarding this most important stage of treatment, but would add that it affords an inexhaustible field for ingenuity, and that upon the intelligence and industry of the nurse very much depends.

Diplegic hands are treated on the same principles as I have enunciated in regard to infantile hemiplegia, and they must be trained to hold sticks and crutches with a firm, unyielding grip. I cannot now deal with individual cases, but I may say I have operated on cases from twelve months to twenty years of age. A large number of these were so bad that they had never attempted to place one foot before the other. Some were structurally flexed (contractured) at ankle, knee, and hip. A most helpless youth of twenty years of age, one limb across the other, was able in six months to stand erect and walk with sticks, and twelve months later could move his limbs north, south, east,

and west, with hardly an appreciable jerk. Success in an ancient case, where so much has to be unlearned, and where the mechanical stage offers so much difficulty, proves the accuracy and efficacy of the principles I have endeavored to support. It is logical to infer that if old neglected cases are amenable to surgical education our prognosis should be very hopeful in the young.

With regard to the degree of benefit to be derived from treatment, the parents should be given to understand that under favorable conditions of nursing and tuition the child, aided by the hand or sticks, will be able to walk varying distances in from twelve months to two years, and with perfectly straight limbs and heels on terra firma. A large proportion of cases will later on manage, aided by one stick. Even in the least successful cases parents, mostly having despaired, are full of gratitude. The mental condition of the children obviously improves when their physical defects are remedied, and they are enabled to mix with their little friends. Complete recovery in spastic paraplegia is, of course, impossible.

It will be gathered from my remarks that I wish to urge that the treatment of spastic paralysis should resolve itself into a system. Such a system involves operative, mechanical, and educational stages. The treatment cannot be separated into parts. If the surgeon is not satisfied that the case is to be under his control for twelve months he will consult his reputation best by leaving it alone. Operations not followed up by careful and prolonged after-care give rise to disappointment and discredit. Merely dividing tendons, to be followed by massage and electricity, is futile and dispiriting.

At the new Liverpool Country Hospital for Chronic Diseases of Children, at Heswall, which we intend to build for 200 patients, we hope to have a ward for these spastic cases where we can keep them as long as needed. The nurses will be specially trained, and no opportunities will be lost from ignorance or neglect. The three months' time limit which English general hospitals impose materially blights the prospects of paralytic subjects. They are neglected at home and wander from one institution to another, often the victims of conflicting theory and diverse

practice. The successful hospital management of infantile paralysis is not complete without an organized system of education be inaugurated. This, in the case of spastics, must often be of the visual as opposed to the abstract type. Apart from its direct influence in improving the mind, we find it to have a sedative influence on the irritable. I have often thought that if there were scholastic institutes for the care of paralytic children of the well-to-do an undesirable gap would be filled. With cheerful surroundings these little ones would enjoy in happy combination a development of both mind and body under the scientific auspices of specially-trained instructors. As it is, treatment is often half-hearted, rarely continuous, entered into with misgivings on the part of the surgeon, and despair on the part of the patient's friends.

NEUROSES AS SEEN IN ORTHOPEDIC PRACTICE.

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The term neuroses here employed is intended to have a generic significance. It includes the more specific expressions which, with more or less definiteness, have been employed; for example, hysteria, neurasthenia, nervous prostration, etc. There are a number of such ill-defined affections having symptoms referable chiefly to the nervous system, which may be conveniently grouped together as neuroses. They manifest a disturbance of functional control, but are not marked by recognizable changes in the central or peripheral nerve tissues.

Because of the disability so constantly accompanying neurotic states, the orthopedic surgeon is frequently consulted, and the duty of deciding whether or not any organic disease be present, and if so, what it is, or whether the case is simply a psychosis, is one which implies a serious responsibility.

In the fact that it is the orthopedic surgeon who is consulted, and not the neurologist, is found some indication of the general characteristics of the particular patients whom he is called to see. Frequently it is a patient who is suffering from traumatism —more frequently slight than severe—and the doubt existing regarding recovery has given rise to nervous symptoms. Sometimes it is found that disease has been present in some bone or joint, and a feeling of disability remaining after recovery gives rise to a condition of chronic invalidism. Most frequently there is found some form of so-called "spinal disease" marked by much suffering or disability, or both.

The so-called "spinal irritation" is often spoken of and treated as if it were a lesion of the spinal cord or its meninges, and it

was so classified by Rosenthal and others. That such a classification is erroneous has been ably contended, and cases here reported will serve to uphold this contention. Instead of the irritation being due to changes in the cord, its membranes or other parts of the spine, it is due to unhealthy and abnormal functionating of the higher centres.

It will appear from reports of cases following that patients who had at one time been affected by some well-recognized disease, but had really recovered, were allowed to continue in the belief that recovery from the disease or from the injury had not taken place.

Of the various causes operating to produce this state of chronic invalidism, suggestion, arising from many different sources, is the chief. Suggestion is a potent influence in the life of all persons, but especially so during the formative period. In childhood and youth the faculties of memory and imitation are at the time of their greatest activity, and in later years the individual as we find him, is the ego made up of the original self as pre-determined by heredity and subsequently modified by education.

Every physician must be able to recall many occasions when the difficulties attending his relationship to his patient have resulted not from real ills, but from hurtful impressions arising from unwise suggestions having their origin in meddlesome and ill-timed inquiries made by professed well-wishers.

From the time that a child cries for food and gets it up to the time when the same child, grown larger, complains of pain or sickness to elicit sympathy, or craves for notice or notoriety, and gets it, the influence of suggestion is ever operative for good or ill. "Whipping a child for a confessed fault imparts a strong suggestion that falsehood is better than truth, with the result that the next transgression is denied and punishment is escaped, and the child soon learns that lying is better than the truth;" on the other hand, the suggestion to a child that it is manly and heroic to endure pain without complaining begets a spirit of endurance and self-control. "As the twig is bent the tree's inclined," and in early life much of the seed sowing is done which brings forth the harvest of neurotics who are but

too well known in their protean aspects to every medical practitioner.

All powerful as suggestion is as an active agent in education and in the production of disease, it may be employed also for beneficent ends in the treatment of many of the nervous diseases and of the psychic phases which manifest themselves in the course of ordinary diseases.

Heredity is an important element which should receive careful consideration. Some of the cases to be reported, which have been most obstinate, show marked neurotic tendencies in both the father and the mother.

In the case of those whose personality is warped by heredity and trammelled by a training which trusts to feelings and whims rather than to reason and reality, mere suggestion that there is some ground for supposing organic disease to be present is often quite enough to nullify feeble attempts at self-government.

Probably the most baleful influence in the production of the neurotic state is found in the home, whether it be in the house of the poor or of the wealthy. Friends and members of the family magnify each complaint of pain and attach to it an undue importance, not knowing that, while on the one hand pain, rightly interpreted, is a valuable aid to lead to the discovery and location of organic disease; yet, on the other, when not carefully questioned and scrutinized, it may run riot with the patient and become a veritable will-o'-the-wisp, leading astray the unwary and uncritical physician.

Sometimes there is a failure on the part of the medical attendant to analyze his case, to apprehend clearly its various elements, and to assign to each phase of the departure from normal health its proper value and true significance.

It is by no means uncommon that organic disease is present, but that the psychic aspect of the case assumes an undue prominence. Under such circumstances it may be peculiarly difficult to distinguish between the true and the false, and even if the distinction be clear in the mind of the medical attendant it may be impossible to imbue others with confidence in his opinions and judgment. Vacillation at this time is ruinous. Error in

arriving at his conclusions may be harmful, but not more disastrous in its effects upon the patient than to waver and show an unsteady hand after he has assumed control. Certainty and exactness of diagnosis are important, but an unflinching course of procedure afterward is not less essential to success. Vacillation but adds to influences already at work, dragging the storm-tossed neurotic from the paths of self-government and sanity.

Under these conditions, and in a multitude of others arising from an unfavorable environment, harmful suggestions arise which keep the patient from regaining the confidence so essential to a satisfactory recovery, and thus a state of chronic invalidism may be continued for many years, all virility being sapped from men and all feminine qualities which characterize true womanhood being blotted out or cast into the mists and shadows.

Though these patients are likely to become self-centred and selfishly, though unconsciously, to magnify their ills because so doing makes them the object of sympathetic attention, yet parents and friends are likely to welcome the coming of a deliverer. Neither these unfortunate patients nor the friends are really fond of the bondage, and though sometimes they may seem to hug their chains, yet it is because the prospect of deliverance is not made clear to them. At first it may not be wise to explain fully one's opinion. This is not equivalent to deception; to practice deceit is the surest road to failure. It is most essential that the one upon whom falls the responsibility of making a diagnosis and upon whom falls the duty of treatment shall reach a very absolute and positive conclusion, that he shall fortify himself for speaking to the patient and his friends in terms of encouragement and confidence.

Perplexed by the often seemingly anomalous train of symptoms manifested by the patient, hampered by the great solicitude and the unwisely exhibited sympathy of the friends, and harassed with doubt as to the extent to which organic disease or pathological conditions resulting from traumatism may account for the illness, the medical man's pathway is often strewn with thorns and his steps endangered by pitfalls. Both for his own

peace of mind and for the liberation of his patient, clearness of mental vision is now essential.

Case X.[1]—G. H. P., aged twenty-seven years, at one time a school-teacher, had studied dentistry for two years prior to the commencement of his present illness. In March, 1896, he walked about fifteen miles and was somewhat exposed in the snow, and his feet and legs became wet. This was an amount of exertion unusual to him. The next day there was numbness in the feet when the head was lowered, disappearing when the head was raised. On the second day the numbness was permanent. This disturbance continued to ascend until it reached a line about two inches below the nipples, and increased in amount until all sensation was lost. Accompanying the numbness there was a loss of muscular power manifested, at first by clumsiness; the paralysis of the lower extremities in a short time became complete. Power over the sphincters of the bladder and rectum was lost. This condition remained constant for about a week, after which sensation improved, first in the vicinity of the right hip, until at the end of six weeks sensation was normal. About a fortnight after sensation began to improve motor power began to return. Control of the sphincters was largely but not entirely regained. Improvement continued until the end of June. At one time during this primary illness the temperature was elevated for two or three weeks, but it never rose above 102° F., and elevation was first noticed about two weeks after the commencement of his illness. At about the end of June a stranger was helping him in some way in bed, and hurt his back. This caused a return of the numbness and of the other symptoms, though they were less marked than before, and were accompanied by no elevation of temperature. At the end of another month there was considerable improvement, which continued until the spring of 1897. In the meantime he suffered from a severe attack of la grippe, with elevated temperature. During the summer of 1897 he frequently sat up in bed, but had another

[1] The cases are numbered in order, following similar cases reported in Vol. XIV. of Transactions, p. 24.

setback, attributed to not being sufficiently careful while moving in bed. In the spring of 1898 electricity was employed, but he claims that the current was too strong, and again he had a relapse. In the fall of 1899 he had some apparatus to assist him in sitting up and to bring him to the sitting posture very gradually. At one time he succeeded in getting out upon the floor and could stand by a table placed beside the bed, and even move about with crutches, but again had a relapse caused by overexertion. This record of "ups and downs" has continued until recently. During these years he has been in various hospitals and sanitaria under treatment. He was twelve months in the Toronto General Hospital, for a considerable length of time in the General Hospital at London, in a sanitarium at Battle Creek, Michigan, and finally in the Home for Incurables, London. This patient came to Toronto Orthopedic Hospital October 31, 1901, and remained until May, 1902. He was unable to walk, and had not done more than walk about the ward with crutches for several years. He lay or sat up in bed nearly all the time, had no motion of the bowels without an injection, did not empty the bladder at any time, but kept a urinal in bed constantly, allowing the urine to dribble away without making any effort at any time to complete the act of micturition.

When I directed him to dress and come with me to the gymnasium he asked to be allowed crutches, but, having found by previous examination that there was fairly good power in all his muscles, I positively refused to allow any aid except the guidance of my hand directing him as he came down the stairs through two rooms to the gymnasium. He remarked that he had done nothing like it for five and a half years.

Seeing that he was unable to keep his balance when attempting to walk, a trolley was arranged with a car running on a track about six feet above his head, from which a rope extended downward to straps under the chin and occiput, such as are usually employed while applying a plaster-of-Paris jacket. This prevented him from falling while learning to walk. At first it was with considerable difficulty that he was able to use enough force to propel the little car. He made gradual but continued improvement, and within a few weeks could walk rapidly to and

fro across the gymnasium floor. As soon as he was able to balance he was gradually inducted into the ordinary gymnasium work, until at present he is able to do a large part of the exercises which are usually done (February, 1902).

The nurse was instructed to allow him the urinal once in two hours, at which time he was to make a definite effort to empty the bladder. Each day a rectal injection was prepared for him, and he was allowed to go to the closet and use it himself. After a short time he was refused the use of the urinal entirely, and soon he showed his ability to go back and forth to the closet as circumstances required. For a long time he remained pale, walked with a very stiff gait, and showed but little comparative interest in his own welfare and progress. His urine is alkaline, loaded with débris, and he is now taking a mixture of benzoic acid and salol. As soon as the fine weather came he was urged to go out-of-doors and virtually compelled to adopt active habits, such as to practice running, etc. Early in May he went to the country to work upon a farm, and writes me that he is still improving (June, 1902).

I would not presume to have an opinion as to the amount of real disability present at the commencement of his illness, due possibly to congestion of the cord, but I think it is safe to say that the first link of his vicious chain was forged when, early signs of recovery having appeared, he was put back to bed again at the slightest professed indication of numbness, pain, or disability.

Although this man is working up to a sense of his condition, and shows an increased interest in and appreciation of his duties and relationships as a citizen and a responsible member of society, yet there is no probability of his ever regaining his normal health and manhood. Irremediable injury has been done him, the elements of his character have been sapped, and he will bear with him through life burdens which have accrued during years of needless invalidism.

Case XI. E. D., aged twenty-seven years. In June, 1901, this young woman sprained her knee slightly, stepping off a street-car, and the next day felt a pain in the same knee. Still

finding discomfort in the knee at the end of two weeks, she consulted her medical adviser. For several months following the knee was treated by rest in bed, by having a plaster-of-Paris protecting splint, by counter-irritation, etc. Some time during the winter the conclusion was reached that the knee was tuberculous.

Being consulted in February, I found the knee slightly smaller than its fellow, no local elevation of temperature, a moderate degree of atrophy of calf and thigh, no elevation of body temperature. No infiltration or effusion in or about the joint was manifested to eye or fingers. A skiagram revealed nothing differing from the other knee. I could not learn that there had been any other signs or symptoms to arouse suspicion besides pain and a vague feeling of disability and discomfort. An older sister had fallen some years previously and suffered a fracture of the neck of the femur, and is lame. A great dread of permanent lameness possessed the minds of the family and the patient. I thought the conclusion justifiable that there was neither fracture, displacement, nor disease of any of the structures entering into the formation of the knee-joint nor of the extremity. The patient came to Toronto and directly under my supervision. I advised gradually increasing use of the limb. Some difficulty was experienced in getting her entire confidence, as frequently there was complaint of pain. Daily massage and active systematic work for three months have almost completely overcome all doubt in the mind of the patient, and all feeling of disability and discomfort in the knee.

Case XII.—W. D., aged twenty-two years. About two years ago her wrist was scratched with a pin, and after becoming septic it was found impossible to heal the wound. Gangrene occurred, and after amputation of the forearm, gangrene appeared in the stump, and a secondary amputation was necessary. The extremity of the stump is now found about the junction of the upper and middle thirds of the upper arm. Having complained much after this of pain in one side of the abdomen, an intrapelvic operation was performed through the vaginal canal. Just what was done in this operation I do not know. This was performed in the spring of 1901. In July it was noticed

that the left hip was very prominent, and she soon began to walk, with a very marked limp. She consulted Dr. Galloway in January, 1901, because of the very marked lateral curvature which was present. Ascertaining that the curvature had come on very rapidly, and finding that the shoulder was drawn down very close to the hip upon the same side that had been operated upon, it was thought possible that some morbid intrapelvic condition accounted for the deformity. Careful examination by Dr. S. M. Hay afforded no information justifying this opinion, as the parts were declared to be normal. While under anæsthesia it was found that the trunk was easily straightened. She seemed much pleased to report that she had undergone nine operations.

It was advised that she come into the Orthopedic Hospital and be constantly under supervision for some time. Her chapter of mishaps seemed to continue, and a very short time after admission she spilled very hot water upon her foot, causing a troublesome scald. She has been kept daily, except while laid up because of the accident, at work in the gymnasium. Suspension of her weight through the spine has been made a prominent feature of her work, while heavy dumb-bells have been attached to the leg shortened by tilting of the pelvis.

Early opportunity was taken to tell her candidly about her condition and the necessity of assuming self-control and ridding herself of various habits which were standing in the way of her best welfare. She has proved a docile patient. Such training during five months has resulted in very marked improvement, the curvature of the spine having almost entirely disappeared, leaving her with a scarcely noticeable limp and greatly improved health and appearance. When she came to the hospital her appearance was that of debility; she had lost all self-confidence and yielded herself a ready victim to her real or supposed misfortunes. Only two days ago she came to me and said that she was desirous of returning home, stating that her mother and sister were ill, and that she felt it her duty to return and take care of them and assume charge of the work needed by the family. She is self-confident, and firmly believes that she will be able to bear well her part.

Case XIII.—L. P., seventeen years of age. I saw her first in October, 1900. Her spine was very tender, especially in the lumbar and sacral regions; she could not lie down because of the pain experienced in doing so; walked with a peculiar limp, turning the right foot over upon its outer border at each step; complained of weak eyes, a condition which was said to be due to "disease of the spine;" gave rather a vague history of having sprained both knee and ankle. Her mother was greatly surprised at being told that both joints were in a healthy condition.

Examination of the trunk showed perfect mobility of the spine but great "spinal irritation." Examination of the right foot and leg showed that the peronei muscles were active and possessed a fair degree of strength, although she had been told that the turning of the foot was due to paralysis of these muscles.

This girl's mother had a worn and worried appearance and a very nervous manner. While in my office she talked incessantly of this girl's illness and great suffering and of her husband's "nervous prostration." He was then in a sanitarium under treatment, his nerves having given way under the pressure of business. Up to the present he continues to be an invalid.

The mother arranged to bring the girl to me for treatment, and then changed her plans, wrote me, inquiring about many points, came to consult me again, and again delayed. Finally she brought her daughter to the hospital to leave her with me, in October last.

Notwithstanding that I had had plenty of opportunity to make observations, yet, in a moment of weakness, I consented to the mother remaining in the city for a week, and allowed her full liberty in calling upon her daughter and in taking her out to visit friends. Throughout the girl's stay with me, I realize now, a mistake was made in allowing too great laxity of discipline. She remained during six months, but, owing to the interference of many incidental things, such as continuing a long attendance with a dentist for the care of her teeth, and visiting friends in the city, her progress has not been satisfactory.

She has returned home very greatly improved, but in a condition which will permit, I fear, of speedy relapse, because of her home environment.

From my experience with this patient and from my observation of her present condition, I have learned the lesson that it is much better to incur the dislike of the friends and to lose the patient than to be led into giving consent to a course which is detrimental to the patient's highest welfare. In the case of this patient it was necessary not only to contend with the opposition of the family, but to deal with a case whose heredity made it very difficult to accomplish satisfactory results.

Case XIV.—N. M., nineteen years of age. Dr. Galloway was consulted by her in the summer of 1901. She was one of a number of girls in the family, and was said to have been an invalid for a number of years, receiving constantly the sympathy and attention of her mother and sisters. On inquiry it was found that one of her most prominent characteristics was her being subject to a form of "spasm." Careful inquiry into this showed that they were not epileptoid in character, but cataleptic. For months previous to the time of the consultation she had been confined to bed during a considerable portion of the time, and without being able to assign any definite cause for her condition, the family seemed convinced that she was quite a confirmed invalid. A request to treat this girl in her home was met by a prompt refusal. The family was informed that no responsibility would be assumed for her treatment unless she came to the hospital, did not receive visits from her family or friends, and would not be permitted to go out without permission. She was assigned the regular work in the gymnasium as a means of engaging her attention and exercising discipline. Very shortly after her admission she seemingly became unconscious, and the direction was given simply to carry her into the next room and leave her there. Having assured ourselves that she was in no danger, she was left unmolested for a couple of hours. At the usual time for the next meal, she was roused up brusquely and asked to go to the ward, as it was time for supper. Only once afterward did she allow

herself to get into a similar condition. She soon fell into the routine of the regular hospital and gymnasium régime, increased in health, strength, color, and vivacity, and at the end of three months returned home convalescent.

Those who have given most attention to these patients and have sought to alleviate their ills will be the most ready to admit that great injustice is often done them. When once the conclusion is reached that the train of signs and symptoms manifested is not due to organic disease, but rather due to the psychic attitude of the patient toward herself, there seems to be a strong tendency to underestimate the suffering endured and the disability experienced, and, in consequence, to deal with the patient harshly, as if intentional fraud were being practised upon the friends and the medical attendant. On the other hand, the error most commonly made, especially by the friends, is to lay too much stress upon pain and to express an unwise and a misplaced sympathy, which but confirms the unfortunate patient in her wrong course, and strengthens the chain of circumstances which make up the vicious circle in which she is moving.

In this connection it would be wrong to free the practitioner from the blame which frequently attends his vacillating course. If uncertain as to the exact diagnosis he should have a consultation, or otherwise so strengthen himself as to be able to pursue a course having a definite end in view.

It is unwise and unfair at this point to place too much blame upon those attending directly upon the patient; the difficulties which present themselves in the effort to sift the true from the false are so great that it would be unreasonable to expect the family and friends to be able to make the distinction, and the experienced medical man may be taxed to the utmost. When treatment, however, is to be undertaken, this distinction must be clearly made. Exactness of diagnosis is essential and must be the first step toward treatment.

Next, the causes operating to produce a continuance of the disease. Among the most important will be:

1. Injury to some part, generally slight in itself, but magnified in importance by some attendant circumstances.

2. Disease, recovery from which is not recognized, or a con-

sequent disability—which is greatly magnified—attended by a fear that the natural use of the part may be harmful.

A large number of the cases seen had their starting point in either of these ways. It is a crucial point to be able to distinguish sharply and to estimate correctly how far we may go in restoring the suspected joint or member to its normal function. I am convinced that the orthopedic surgeon frequently falls into the temptation to continue, to the detriment of his patient, protection of a joint by means of braces much longer than necessary. When it is safe to restore any part to its intended use it should be done not only in the interest of the part affected, but of its general effect upon the patient.

3. *The Home Environment.* Separation from the surrounding circumstances to which the patient has been accustomed must be practised in the majority of cases. I have not said isolation, for I am convinced that such a course is seldom wise. There may be patients whom it is wise to separate from all the world, except the trained nurse and the medical attendant, to be kept in bed, to have massage, and to be dieted, in order to increase "fat and blood," but they are not the cases that the orthopedic surgeon is called to advise.

It is not so much a cessation of activity—mental and physical—that these unfortunates need as it is that their energies shall be directed in right channels, that they shall be led not to think so much of themselves, but to centre their attention upon interests and aims outside of their own personality; in a word, to beget in them and to cultivate a true altruism, and to suppress a corresponding, debilitating egotism. The surroundings should be such as to arouse interest, new, if possible, cheerful always, having an evident useful purpose, calculated to inspire self-confidence and to suggest a personal responsibility. The course adopted should be marked by regularity and system, should not be haphazard on the one hand, nor fall into mere routine on the other.

It may be that the patient by long continuance has fallen into a state nearly approaching physical and mental imbecility. If so, someone must do her initiatory thinking and assume a control that is akin to hypnotic control, must exert a force of

manner and action which will be substitutionary; but at every step of the way the patient must be shown that personal effort is called for and is quite possible and practicable.

4. *Heredity.* Heredity is frequently both a direct and an indirect cause: first, because of the natural legacy which it implies, and then because such parents constitute a hurtful environment. This should receive careful consideration in giving a prognosis.

Frequent reference made in this paper to the orthopedic gymnasium calls for some explanation as to the place and importance assigned it in the management of these patients. While the general work done in it is helpful as a means of obtaining exercise, yet it is not chiefly for that reason that it is employed. It has been said that the chief desideratum is discipline and the creation of an ideal toward which the patients may reach, the establishing in each one of a clear conception of personal duty and responsibility, and the confidence that application will reach the ideal and will insure that the responsibilities imposed by society will be creditably borne. I do not know any means more ready to hand and more efficient as an aid to discipline, more helpful to free, genial, wholesome association with one's peers than is afforded in a properly conducted gymnasium. It is not held that any special movements performed have a specific influence in treatment; but while these in themselves are helpful, there is a power far beyond this. A successful, tactful director has an opportunity to cultivate an *esprit de corps* and concentration of attention upon something outside of self that is not easily secured otherwise. It requires knowledge, good judgment, tact, firmness, and a manifest devotion to the interests of others to direct this work successfully.

Class work has marked advantages over individual work, as it insures the greatly desired association with other persons and affords the director the opportunity to bring into full play the pedagogic practices based on emulation. In suitable weather and where a suitable campus is available, there is great gain in out-of-door exercise under competent supervision.

Actual disease or disability should be remedied as far as possible by surgical or other means. In Case IV. marked con-

tractures of the muscles controlling feet and knees had occurred, and it was impossible to make any progress until this condition was remedied. When there is actual cause present to account for loss of function, it is quite as much an error in treatment to overlook or underestimate it as it is to exaggerate slight or imaginary ills.

The general physical conditions present should receive attention; for example, the habits as affecting the action of the bowels and bladder, occupation, diet, exercise, etc. Most erroneous and ruinous practices will often be discovered. In Case X., reported here, a natural motion of the bowels had not taken place for years, the bladder was never empty, and no effort was made to empty it, but a urinal was kept constantly in bed with the patient, and the urine was allowed to dribble away. All such conditions must be grappled with by a strong hand and regularity restored.

Nutrition should be carefully considered; such food should be supplied and such regulation of diet should be secured as will insure good nourishment.

In all that pertains to the life of the patient a strict regimen should be maintained. If home influences have been hurtful, friends and relatives should not be allowed to visit or correspond with the patient. Association with other patients similarly affected may be injurious, unless it come directly under the eye of a competent attendant. Frivolous and foolish reading and conversation, the officious interference of an indiscreet nurse, or the well-intended but meddlesome attentions of other patients may be a source of much harm. The manner of life of the patient for every hour of the day should be known and should be guarded from every harmful influence. Discipline, always kind but clear-cut and unwavering, must be maintained.

Omission of the advocacy of treatment by drugs, baths, electricity, etc., does not mean that the writer undervalues these aids; they have received ample consideration elsewhere.

Education in its widest sense and properly understood as applied to them contains the greatest hope for these patients; it has within it the germ of all the harvest of good which they may reap. It implies, after the confidence of the patient has

been secured, instructions as to the harmful influences which have been at work, whether in the home or elsewhere, the formation of habits of diligence, the avoidance of gloominess and moodiness on the one hand, and of frivolity and sentimentality on the other; an earnest outlook upon society, appreciation of the fact that there is work for each one to do, and victories to be achieved which can be accomplished by application and intelligent, purposeful exercise of the individual will.

INTERNAL DERANGEMENT OF THE KNEE-JOINT.

By FRANK E. PECKHAM, M.D.,
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Internal derangement of the knee-joint is a phrase applied to a certain set of symptoms which are usually pretty definite. These symptoms are caused by a displacement of the semilunar cartilages. This may be very slight with an immediate return to its normal position, or it may have all grades of severity up to complete dislocation, with a firm locking of the joint in consequence. The accident may take place after some simple motion, as getting up out of a chair, or suddenly getting up from a stooping position, or after some severer accident, as being thrown from a bicycle or being suddenly thrown against some hard object; or the reverse, as having some object thrown forcibly against the knee-joint. The simpler forms of this trouble give rise to the milder symptoms; but even these cases are very apt to need treatment before the knee symptoms disappear.

With lax ligaments there may also take place a nipping of the folds or shreds of the synovial membranes between the ends of the bones. A piece of fringe may become entirely separated and, floating about, cause a locking of the joint.

The symptoms of internal derangement are somewhat typical. The trouble usually dates from some accident or from some slight wrench or twisting of the joint, after which the knee is weak. If the accident has been a slight one effusion is not so apt to occur, although usually it is present; but the joint is weak, giving way at intervals and causing the patient to fall, followed a little later by the actual locking of the joint. The

knee becomes locked in a slightly flexed position, is painful, tender, particularly on the inner side of the patella, and it is impossible to completely extend or straighten it. At the time of the accident there may or may not have appeared a bunch on the inner side of the joint, with a story of its having slipped back. Any attempt at manipulation causes intense pain. After the subsidence of the acute symptoms, either with or without treatment, the patient gets about again, but the knee is troublesome. In the more marked cases it cannot be completely extended, and, consequently, there is a limp in walking. The giving way or the locking takes place at intervals and each one leaves the knee somewhat more tender, until finally the patient becomes practically a cripple.

There is another class of cases which should be mentioned, where the trouble comes on gradually, without the patient being able to recall any particular wrench or accident as a cause. In examining these cases carefully I have found a laxness of the ligaments in the other knee and in the other joints, so that the gradual onset is easily explained. Such a case was that of an old lady, sixty-eight years of age, who consulted me last fall. She complained of both knees "cramping," as she expressed it, then something would slip, the cramp would disappear, the knee would straighten, and then everything would be all right again. Examination showed a general laxness of all ligaments, and undoubtedly here was a typical case of internal derangement or slipped semilunar in both knees, of gradual onset, without the history of any kind of accident.

The physical signs of this condition are always very marked. The first thing noticed is the lateral mobility of the joint, and in some cases the amount of motion possible is surprising. The ligamentum patellæ is elongated on the affected side in many cases. There is inability to completely extend the leg. This is not only due to the lengthened ligamentum patellæ, when present, but more especially to the bruised and swollen edge of the semilunar cartilage. The flexion is not due to a foreign body between the ends of the bones, because under ether it cannot be reduced, and under treatment it gives way slowly and gradually, corresponding exactly to the subsidence of the

inflamed and swollen cartilage. It is usually the internal cartilage that slips out, and, consequently, there is almost invariably a point of tenderness on pressure on the inner side of the patella. The thigh muscles are usually atrophied.

A brief review of the anatomy and the mechanics of the knee-joint makes clear the train of symptoms and the effectiveness of the mechanical treatment of the difficulty. The anatomical parts which become of particular interest are the internal lateral ligament, the crucial ligament, the ligamentum patellæ, and the semilunar cartilages, especially the internal semilunar. When the leg is completely extended the lateral ligaments hold the joint firmly and prevent any lateral motion. The rectus muscle, acting through the quadriceps extensor tendon, the patella, and the ligamentum patellæ, holds the joint firm and rigid from the front. In partial flexion the same structures also hold the joint firmly, and in complete flexion the crucial ligaments are made tense, and thus prevent some motion laterally. All these ligaments hold the knee firmly under ordinary conditions; but when the knee is flexed a certain amount of laxness takes place in the lateral ligaments, and any motion which causes even a slight twisting (rotation) of the tibia would allow some slight separation of the joint surfaces on the inner side, and might cause the semilunar cartilage to be pushed forward and inward. Then would come the sudden pain and the sensation of something bulging on the anterior and inner side of the knee. The posterior portion of the ligament may thus get caught between the femur and the tibia behind, and thus the joint may become locked, so that motion is impossible either way until the cartilage suddenly slips back into place, when motion is at once restored.

The treatment of this condition, if seen immediately after the accident, is rest in bed, with the application of some stimulating liniment, such as soap liniment, followed by massage. If the joint is extremely tender, so that any motion causes pain, then fixation is necessary, and preferably by means of plaster-of-Paris. In young people, at a first accident which is not very severe and the effusion only slight, if any, the stimulating liniment and massage may be entirely sufficient; but if a second

accident occurs, then apparatus should be applied without delay, and continued until the cure is complete. In adults these accidents, if not very severe, are apt to cause more disturbance than in the younger people (under twenty years of age, perhaps),

Splint showing the principles of a Shaffer apparatus for internal derangement of the knee-joint.

and when seen immediately after the injury are much more apt to need bed treatment and fixation. The nature of the injury also has a great deal to do with the severity of the symptoms. For instance, a railroad injury would usually cause more

trouble than a slight twisting when getting up out of a chair. In the great majority of cases the knee is not seen until the patient has been troubled for some time; consequently the treatment must be entirely different. In these patients and in the ones seen early after the preliminary treatment is ended and the knee still remains troublesome, the slipping out of the semilunar cartilage must be prevented. This can be accomplished by a mechanism which causes a lateral pressure to be applied upon the inner condyle, thus preventing any separation of the condyles. By grasping the thigh firmly and being attached to the bottom of the shoe it prevents the rotation or twisting motion of the tibia, which is such a common cause of the accident. There is also a stop-joint at the knee which prevents it from going back far enough in walking to put any strain on the posterior ligaments of the joint. If these three things are accomplished the pain disappears, and the accident becomes an impossibility while the apparatus is kept properly adjusted. Such an apparatus has been described by Dr. Shaffer, and it is that apparatus which I have made use of, and the results have been so surprisingly and uniformly excellent that I wish to report a number of cases.

Case I.—A young girl, sixteen years of age, twisted the right knee in dancing. Something was felt to slip on the inner side of the patella, and the knee at once became tender and painful on motion, and a slight amount of swelling was present. The patient, living in the country, made use of home remedies and remained off her feet. One week later she reported at my office for advice. At this time there was tenderness on pressure at the classical point, and no effusion was present. There was some pain and a slight limp on walking. Soap liniment and massage were advised, and in a week the knee was well, and there has been no return of the symptoms, now nearly a year after the accident.

This case fairly represents a type seen in young persons, the most of them doing well with the simple treatment described.

Case II.—A girl about twenty years of age had complained for about one year of the left knee "slipping," as she expressed

it, and feeling as if it were going to give way under her. It was getting more and more troublesome, so that she sought advice in May, 1900. There was no history of injury, but the onset was gradual. There was no elongation of ligamentum patellæ and no atrophy of thigh muscles. There was present lateral mobility of the joint, and the knee creaked on motion, and some of the other joints were also creaky.

A regular Shaffer apparatus was applied, which gave immediate relief to her symptoms. This apparatus was worn for a little over one year, when it was omitted, and the knee has remained in excellent condition ever since.

Case III.—A girl, seventeen years of age, sought advice in April, 1900. Three years previously she had fallen from the bed to the floor in her sleep, injuring the left knee. She was laid up for a few days only. Two years later she had fallen from her wheel and injured the same knee. From the first accident the knee had caused some trouble, but since the second the symptoms had become aggravated, so that often there was a sudden giving way, when she was liable to fall. On one occasion she fell to the floor while dancing, and advice was sought for fear of actual injury in some of these falls. The patient was a large, fleshy girl. There was no elongation of the ligamentum patellæ, but there was increased lateral mobility of the left knee. There was no atrophy of the thigh and there had been no locking of the joint; but before the apparatus was completed this locking took place while in bed, so that for a few minutes she could not move the knee either way. The apparatus was finally applied in June, 1900. There was complete relief of symptoms, and in the summer of 1900 the patient went abroad and did a great deal of walking with entire comfort and freedom from accident. One year later while playing basket-ball, without the apparatus, she sustained a very bad sprain of this knee-joint, on account of which the apparatus was worn for three months longer, and then omitted for good. There has been no return of symptoms.

These last two cases also represent a type. Here the important symptom was the giving way of the knee and no locking

of the joint. The last case confirmed the diagnosis by the locking of the joint before the apparatus was applied.

Case IV.—A young man, twenty-one years of age, a hostler, was in a box car with a horse. This car was switched onto the main train with so much force that he was thrown down and the horse on top of him, striking and severely wrenching his right knee. The knee was locked so that it could not be moved either way (flexion or extension) until the following day. It was very painful, and a bunch could be felt on the inside of the joint. I first saw the case on the third day following the accident. The knee was flexed at an angle of 165 degrees with the thigh. Beyond this point it could not be extended. A slight amount of motion in flexion was possible, but painful. There was much tenderness about the inner condyle and along the inner border of the ligamentum patellæ. The circumference of the right knee was three-quarters of an inch greater than its mate. The treatment was rest in bed and acetate of aluminum externally. The knee improved, but inability to extend beyond an angle of one hundred and sixty-five degrees continued, consequently the usual apparatus was applied in the third week following the accident. The stop joint at the knee was arranged to stop at one hundred and sixty-five degrees. In one week the pain had completely disappeared, and in one month complete flexion was possible with the apparatus on, and early in the third month complete extension was possible for the first time. This young man omitted his apparatus, contrary to advice, after wearing it about six months. It is now about one and three-quarters years since the accident, and there has been no return of symptoms.

Case V.—A rather fleshy woman fell from her wheel in September, 1898. She was unconscious for a while, and could not tell exactly how she struck; but the right knee was very much swollen, red, and tender. The treatment at the time was a splint for ten days, when she got up and began to hobble about, and slowly improved in ability to walk. She was unable to flex the joint very much, on account of pain. The knee during all

this time would give way, and she was in constant danger of falling. The inner side of the knee has always remained tender. The patient consulted me three months after the accident, at which time there was considerable lateral mobility and very marked tenderness to pressure all about the inner condyle. The leg could with some difficulty be completely extended. The circumferences of the right leg were less than the left: calf, right $16\frac{7}{8}$ inches, left $17\frac{1}{4}$ inches; knee over patella, right 18 inches, left $18\frac{1}{2}$ inches; thigh, right $21\frac{3}{4}$ inches, left $22\frac{1}{2}$ inches.

The usual apparatus was finally applied about the middle of January, 1900. In a week the pain had disappeared from the knee, and she could walk very comfortably. Improvement continued steadily, and during the summer of 1900 she spent six weeks or more in the mountains, walking about everywhere with entire freedom from symptoms. In December, 1900, after wearing the apparatus a little less than a year, it was omitted and there has been no return of the trouble.

It seems sometimes almost wonderful to see patients practically crippled and unable to get about to do their customary work, when, after having the apparatus adjusted, they are immediately able to get up and walk and go about their work. I shall briefly mention three such cases.

Case VI.—A woman, about forty years of age, gave a history of both knees giving away under her; but the left one had not troubled her in about ten years, while the right one had become locked eight weeks before consulting me. This happened while the patient was asleep in bed, so that when she waked in the morning it could not be moved. The treatment had been a posterior splint. The patient was unable to walk at all, and was brought to my office in a carriage. During the next two weeks, while the apparatus was being made, the splint was omitted and very moderate use of the knee was allowed. When the apparatus was applied a friend with whom she was visiting was taken sick, and this patient was actively engaged in caring for her, going up and down stairs with perfect ease. The relief was immediate.

Case VII.—A woman, fifty-five years of age, had been very much crippled for a year with an internal derangement of the left knee-joint. The knee was flexed and, as she was very fleshy, it was with difficulty she could hobble around. The usual apparatus was applied, and immediately walking was made comfortable, and in one month the knee could be completely extended.

Case VIII.—A man of about thirty-five years of age while wrestling twisted the leg in such a manner that the cartilage was displaced, and he had been unable to work for six weeks. Immediately the apparatus was applied he returned to work.

These three cases show how *immediate* is the relief when proper mechanical treatment is applied.

One case to show that even when the trouble has existed for a long time, it is still advisable to apply the mechanical treatment:

Case IX.—A man of thirty-nine years of age. The first accident was in 1884, with recovery. The second was in 1886, and it had been more or less troublesome ever since, until finally he had to walk with a cane all the time and use the greatest care in getting on and off the electric cars. The knee was flexed at an angle of one hundred and sixty-five degrees with the thigh. Atrophy was present, and there was marked tenderness about the inner condyle. Apparatus was applied in September, 1900, and he has been comfortable ever since. I have carefully examined the knee this last spring, and it seems to be perfectly well. He has been urged to omit the apparatus, but is so afraid that something will happen that he still continues to wear it.

Case X.—A woman thirty-eight years of age. In this case the patient does not remember any particular accident, but says the trouble came on suddenly two years before consulting me. The knee became locked four times in two years, and the last time it remained locked thirty-one hours. There was no atrophy, and the leg could be comfortably extended. There

was a slight amount of lateral mobility. This case looked somewhat suspicious of floating cartilage, but the usual apparatus was applied in November, 1901, and thus far no accident has occurred.

In my experience the "giving way" of the joint is the most common symptom, and at first I was in doubt as to its going on to a locking of the joint, but subsequent observations have shown that this happens almost invariably if allowed to go untreated. The results of mechanical treatment have been such as to lead me to think that operative treatment would be necessary only in cases of floating cartilage, or a long piece of fringe, which would practically amount to the same thing.

REPORT OF A CASE OF OSTEOMA OF THE KNEE-JOINT.

By R. TUNSTALL TAYLOR, M.D.,
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I HAVE been put down on the programme for a paper on "Loose Bodies in the Knee-joint," but I simply wish at this time to report the following case as being of special interest and unusual first, from the very large size of the osteoma found; second, to emphasize the great importance of the skiagraph in making diagnosis possible in such cases; and, third, the value of the X-ray in pointing out the proper mode of treatment, especially as it was necessarily not palpable.

Such a case as this could have been painted with iodine, worn elastic stockings and various braces (such as the Campbell brace), had massage and electricity indefinitely without cure. Nothing short of the radical removal of such a partially loose body in the knee-joint could afford relief.

I do not consider that there is any more danger in opening the knee-joint, even for exploration, than in opening any serous or synovial cavity elsewhere; but the most scrupulous technique in asepsis is necessary.

January 14, 1902, Miss J. H., aged nineteen years, presented herself for treatment. Her family history was negative, and her past history had no bearing on the present trouble, having had an attack of appendicitis six years previously. Her present trouble began four years ago. She was going to school one morning, and stepping from the street to the pavement her foot caught on the curb and her right knee gave way, bending backward violently. She went to school and thought no more about it until she started to rise, when she found she was unable to

straighten the knee and could bear no weight on that leg. She was carried home, and could not use her leg for four weeks, when it gradually improved, and she was able to bear her weight upon it again; but motion in the knee-joint remained permanently limited to one hundred and fifty degrees in extension. The joint was at first slightly swollen and quite painful, aching, and throbbing. Atrophy at, above, and below the knee was present when she came to me. A point of maximum tenderness was just under the patellar ligament. There was at no time any constitutional disturbance. The patient had been treated for two years for rheumatism and had had local massage. She did not improve under this treatment, it is needless to say, and had no further treatment until October, 1901, when she consulted me. Operation was advised, but static electricity and massage were tried for three months. The knee was made more comfortable under this treatment, but motion in the joint did not become any more free, and tenosynovitis was constantly present over the quadriceps and patella tendons.

Three X-ray pictures of the joint were taken, and showed a foreign body in the joint, which projected from and into the intercondylar notch, and which the X-ray stereoscope showed was apparently attached to and nearer the external side of the internal condyle.

January 15, 1902. Patient was operated on under ether. An incision about four inches (12 cm.) in length was made on the inner side of the joint, the capsule was opened, and the joint exposed, when a foreign body was seen occupying a position between the condyles, as shown in the skiagraphs. (Fig. 1.) On looking in the joint this body at first appeared to be the size of a small marble, and was movable. On further examination the body was found to project into the intercondylar notch; it was attached above to the under surface of the patella by the plica patellaris synovialis and on its medial side to the internal condyle. After several attempts it was found to be impossible to remove the body from the inner side without considerable trauma to the joint, so that a counter incision was made on the outer side and the joint exposed as on the inner side. The foreign body was then grasped by long forceps on

the inner side, being pushed from the outer, and its attachments loosened with a curved scissors. It was situated outside of the synovial membrane, but surrounded by a reduplication of this membrane, and attached to the under surface of the patellar by the plica patellæ synovialis.

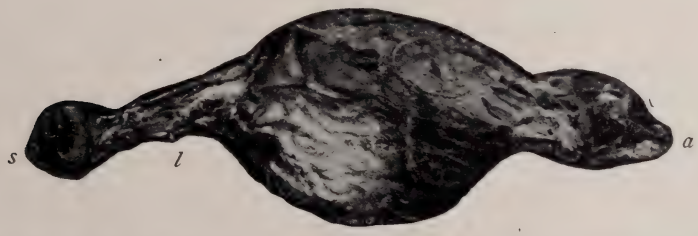
Fig. 1.

Osteoma in knee-joint attached to crucial ligament; bone probably developed from internal intercondyloid tubercle, which was torn loose from tibia at time of accident.

The body or osteoma, when removed, was much larger than it appeared to be on looking in the joint, as the largest part of

it was within the intercondylar notch. Its size is 1 x 1½ inches (3 x 5 cm.) in length and breadth, and 2 inches (7 cm.) in circumference. It was pyriform, its free surface was trochlear in shape and smooth, like the articulating surface of a bone. (Fig. 2.) There was a small sesamoid bone attached by a ligamentous band to the anterior extremity of this large osteoma. This ligamentous band was evidently the anterior crucial ligament, which had been torn loose from its tibial attachment, and in it the osteoma developed. The capsule and skin incisions were closed by silver-wire sutures (continuous and subcutaneous, respectively) and the wound dressed with silver-foil and gauze.

FIG. 2.



Osteoma of the knee-joint. *a*. Anterior extremity. *l*. Remains of crucial ligament. *s*. Sesamoid bone.

From toe to groin the leg was encased in plaster-of-Paris in full extension, which was now possible for the first time.

16*th*. Patient's temperature rose to 101.5° F. as the maximum evening temperature.

17*th*. Maximum temperature (9 P.M.) was 100° F.

20*th*. Dressings changed. Wound healed per primam. Sutures not removed. Temperature has not been above normal since January 17th.

27*th*. Sutures removed. Motion free, and full extension possible.

February 5*th*. Massage given daily.

9*th*. Patient discharged, well, with perfect use and function.

DISCUSSION.

Dr. John Ridlon said that he had seen in the past two years two women, each about sixty years of age, whose history pointed to internal derangement of the knee-joint. In one instance, on attempting to strengthen the leg under an anæsthetic, he very much doubted the correctness of this diagnosis. One woman, while praying in church, had the knee suddenly become locked. When seen by him a week or two afterward the knee was held rigidly at an angle of 55° without pain. When fully anæsthetized he was surprised to find that great force was needed to straighten and flex the knee, and that there was a sound and sensation of breaking up of adhesions. The knee was put in plaster in a nearly straight position, and although the plaster was removed after two weeks, the knee remained in this position ever since. The other patient had her knee locked while kneeling in the garden, and it had remained so ever since, no surgical measure having been attempted for its correction. Both these cases closely simulated ordinary internal derangement of the knee-joint, and hence he thought they should be placed on record.

Dr. W. R. Townsend said that a few years ago he had met with a case which he took to be one of internal derangement of the knee, but several skiagraphs showed nothing. Dr. Shaffer's brace was applied and worn for some time, and then the patient tired of it and removed it. The joint again became locked. She had then been seen by a surgeon, who made an exploratory incision and found a tumor, which was removed. Dr. Gibney had recently opened a knee-joint in the hospital, and had discovered a lipoma in the joint.

Dr. Pegram described a case of an old man, seventy-three years of age, with a floating body in the knee-joint, which had existed for many years. He could only extend to within twenty degrees of full extension. The knee-joint was opened under

cocaine anæsthesia, because of cardiac disease, and he was surprised at the facility with which the operation was done. He removed what appeared to be the posterior end of the internal semilunar cartilage, which had been dislocated and turned upward. Immediately after the operation the patient was able to straighten the leg to within ten degrees of complete extension. He has since discarded the use of a cane as a necessity.

Dr. Shaffer said that he had seen one case like those described by Dr. Ridlon, and had concluded that intracapsular adhesions had formed as a result of long maintenance in one position, plus a rheumatic tendency. He referred to the case of a boy with typical dislocation of the semilunar cartilage, in which he had applied his apparatus, and the boy had resumed his athletic sports. One day the boy removed the apparatus, with the result that the cartilage was again dislocated. This was followed by an immediate and extensive effusion into the joint, so that the joint measured two-and-a-half inches more than its fellow. The boy insisted upon attending his examinations the next day, and the apparatus was consequently reapplied, and with excellent result. The effusion entirely disappeared, and the boy continued at his duties. The secret of success in the use of this apparatus was the lock, which stopped motion just short of full extension. The same principle might be applied with advantage to cases of acute hydrarthrosis.

Dr. Galloway said that it was evident that a large number of these cases could be successfully handled by mechanical means. In one of his own patients there had been numerous attacks of locking of the knee without much provocation. Finally, the time came when the joint could not be unlocked. The leg was flexed at about one hundred and fifty degrees. On opening the knee-joint the external semilunar cartilage was found torn off and its outer portion lay directly across the joint between the condyles and the head of the tibia. In such a case, he thought, no kind of mechanical treatment could be used successfully.

Dr. R. Tunstall Taylor said that he did not doubt that many of these cases could be cured by apparatus; nevertheless, he thought the majority of these cases could be cured quickly by operation. Even if flakes of fibrin acted constantly as an irritant to the joint, he saw no reason why they should not be removed by operation, and thus relieve the patient of the prolonged annoyance of wearing a brace. Still more should this be insisted on when the irritant was cartilaginous, calcareous, or bony.

A CASE OF DOUBLE POTT'S DISEASE.

By R. TUNSTALL TAYLOR, M.D.,
BALTIMORE.

Case.—J. M. F., a boy, aged seven years, presented himself to me for treatment on December 5, 1901. He had a very unusual case of double Pott's disease, with distinct isolated foci

Fig. 1.

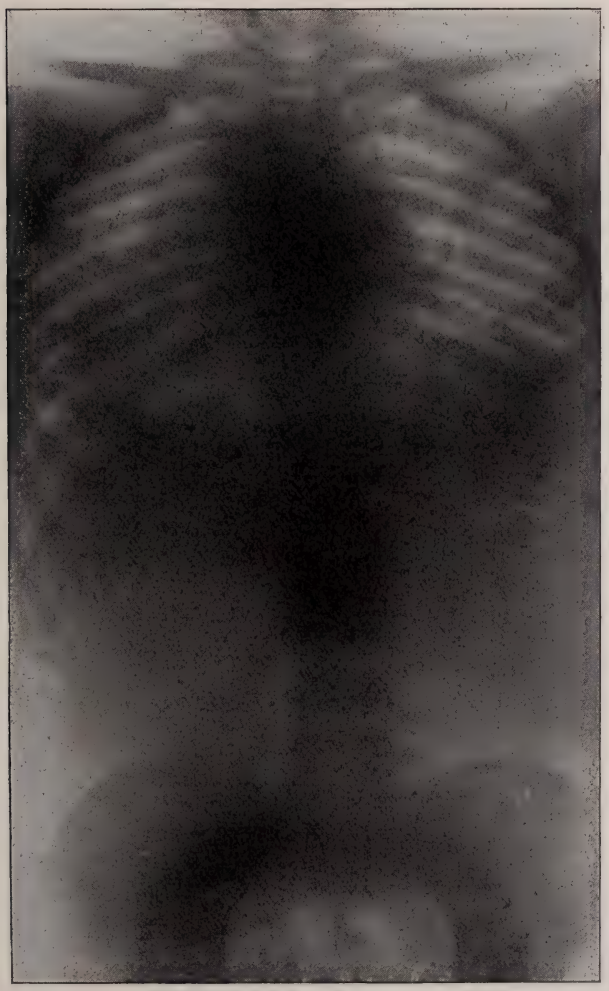
of tuberculous disease involving the fifth, sixth, and seventh dorsal vertebræ above, and the first, second, and third lumbar vertebræ below. Nowhere in the literature have I been able

Fig. 2.

Fig. 3.

to find a similar case, and it is therefore unique. The definition of Pott's disease in all of our text-books is "tuberculous disease in one or more *adjacent* vertebral bodies."

FIG. 4.



The *family history* is negative for tuberculous disease and deformity, except that the paternal grandmother died of pul-

monary tuberculosis, and a maternal uncle of pulmonary tuberculosis and osteomyelitis.

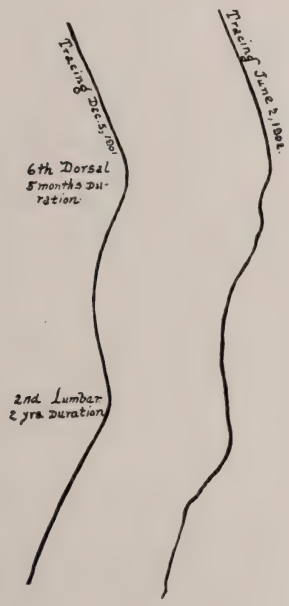
Personal History. Patient was not artificially fed, as is usual in many cases of bone disease, but was nursed as a baby. He

FIG. 5.

walked and talked at one year of age, and dentition was normal. Pertussis was the only infantile disease he had had. The mother thinks his spinal "trouble came from jumping off a straw stack in 1898," but he did not complain of pain in the abdomen until

eight months after, when the *lumbar* disease began; pain was so intense that the patient, as she described it, "could not laugh at all, from jarring caused to the spine." He had the usual malaise, symptoms indicative of the effort to support and protect the spine, with lordosis in standing and walking. Night-cries appeared in 1901, but are not present now. There seemed to be some vesical irritation, as the child got up two or three times nightly to urinate. Five months before he came to me

Fig. 6.



the dorsal disease appeared. This is interesting, as we would expect the lumbar disease to be secondary by gravitation of tuberculous pus. There is now present slight psoas contraction in the left leg. On deep palpation in the iliac fossa a cold abscess, the size of a large lemon, can be felt. This causes no annoyance or inconvenience. There is also left inguinal hernia.

The treatment that I have used has been recumbency on a board covered with a blanket, except for two hours in the morn-

ing and two hours in the afternoon, when he wears the Taylor back-brace, head-support, and apron. Medication consists of cod-liver oil, iron, and nux vomica, and the child is kept out-of-doors as much as possible, which is practically from morning until night. The patient lives in the country, thus rendering the fresh-air element of the hygienic treatment more easily obtainable.

The X-ray of this case is especially interesting, as showing clearly by the intense shadows the two foci of disease—namely, at the fifth, sixth, and seventh dorsal vertebræ, and at the first, second, and third lumbar. At the dorsal focus the lessened space between the ribs and focus of tuberculous disease appearing through the heart shadow are noteworthy. Also in both foci of disease I will call your attention, as Kirmisson noted, to the disappearance or irregularity of the intervertebral disks, and the absence of the quadrilateral shape to the vertebral bodies (*Revue d'Orthopédie*, 1901, vol. ii. p. 405).

The photographs and tracing illustrate this case.

A CASE OF SPONDYLITIS WITH UNUSUAL LATERAL DEVIATION.

By ALBERT H. FREIBERG, M.D.,
CINCINNATI.

That a certain degree of lateral deviation of the spinal column may be present in conjunction with the more or less typical gibbus of Pott's disease has been remarked in a rather casual way by a number of writers. This symptom was not, however, accredited with its proper diagnostic importance in early caries until the appearance of Bartow's[1] paper in 1889. Lovett[2] later called attention to the fact that lateral deviation is an exceedingly frequent condition in spondylitis; that it is often an early symptom, appearing sometimes before the more characteristic gibbus, and that it is to be given an important place as a means of recognizing the disease. Since the appearance of these papers much more attention has been given to the symptom by surgical writers, although even now its description is slighted or altogether omitted in several of the latest and most popular works on general surgery.

The writer has several times seen an acute lateral deviation of slight degree as a symptom of early caries, and shortly preceding the appearance of a posterior projection. That the lateral bend may be the sole element of a very marked deformity, and unaccompanied by even a slight posterior deviation is stated by very few authors, and is unique in the writer's experience. The following case is submitted on this account:

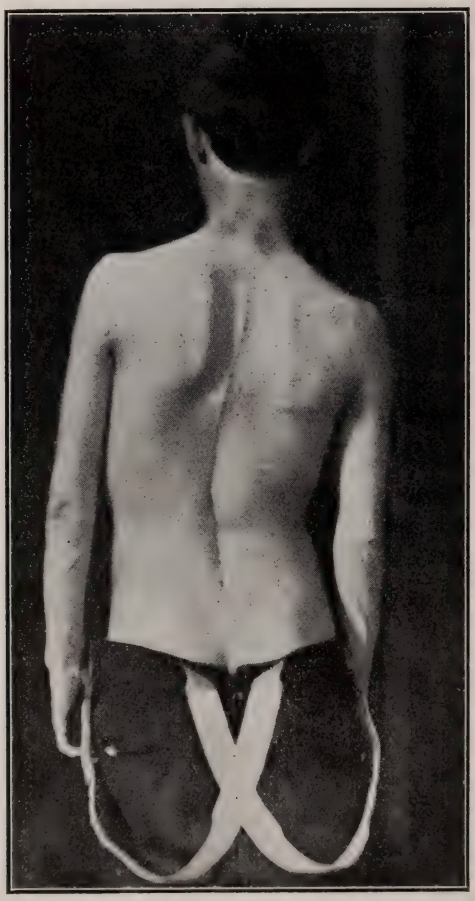
F. H., aged twenty-two years, pharmacist by profession, was referred to the writer by Dr. S. Stark on June 21, 1900. His

[1] Bartow. Annals of Surgery, July, 1889.

[2] Lovett. Transactions of American Orthopedic Association, vol. iii. p. 182 et seq.

family history is entirely free from tuberculosis. He has been rather delicate for several years, and about one year before suffered from "stomach trouble," with pain and eructations after eating. In the early part of May he was taken rather

Fig. 1.



suddenly with pain in the right side of the back. This pain had continued since that time without interruption. He had consulted a number of physicians, and by them the pain had been variously ascribed to pleurisy, intercostal neuralgia, and

kidney trouble. Treatment directed toward these conditions had been absolutely without effect. He had had fever constantly, though never exceeding 101° F., and had emaciated greatly. About June 7th his family noticed that he was "growing crooked" and that his left shoulder was raised. They were quite sure that this was previously not the case. There was no history of cough or hæmoptysis. He had received no injury to which the trouble could be attributed.

The pain, which the patient considered his chief complaint, had been from the outset constant and severe, sufficiently so to interfere greatly with sleep. Although increased by any attempt at motion of the trunk, it did nevertheless not disappear when he was lying in bed. The pain did not depend upon respiratory movement, although deep breathing greatly intensified it. He localized the pain over the tenth, eleventh, and twelfth ribs, and the space just below and external to the costal angles, and on the right side only.

Examination showed him to be a well-developed though emaciated young man of blond complexion. His facies was indicative of severe suffering. His weight was 113 pounds (normal, 135 pounds). His temperature in the mouth was 101° F. His gait was extremely careful and his attitude very striking. The left shoulder was much higher than the right, the interacromial line making an angle of eleven degrees with the horizontal. The examination of the back showed an angular deflection of the line of spinous processes just above the dorsolumbar junction, the apex of the angle directed toward the left. The opening of the angle measured about one hundred and sixty-two degrees from the mid-line of the sacrum; this deflection was diminished above by the presence of a compensatory curve beginning at the seventh dorsal spine. Evidence of torsion of the spinal column appeared to be lacking.

There was no backward projection of the spinal column and the spinous processes were not tender to pressure. A slight diminution of the normal lumbar lordosis was apparent. Pressure on the lateral masses of the eleventh and twelfth dorsal and first lumbar vertebræ on the right side was, however, quite painful. Over the lowest part of the chest to the right of the

spine was an area of superficial hyperæsthesia about twice the extent of the palm.

The stiffness of the back below the scapulæ was very striking. The patient was unable to stoop; the attempt was very painful, and was made by using the thigh as support. Attempts at lateral flexions were abortive and productive of suffering. There had been no pains in the lower extremities, nor girdle sensations. Careful physical examination of the chest and analysis of the urine by both Dr. Stark and the writer yielded purely negative results.

For the purpose of applying a plaster jacket the patient was placed in the oblique prone position in a frame. Before the

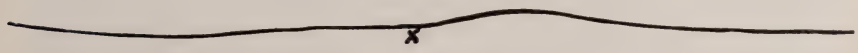
Fig. 2.

plaster was applied he declared himself free from pain for the first time since the onset of his illness. He has suffered no pain worth mentioning since this time. The patient was kept recumbent for about three weeks, and was then cautiously permitted to move about. His condition improved steadily. On October 12th his weight had risen to $131\frac{3}{4}$ pounds. Temperature had all along been above 99° F., but was now normal. No pain whatever. Spine still quite stiff, particularly in flexion. No tenderness. Cast taken for rawhide jacket.

The patient was last examined on April 10, 1901. He has been wearing the rawhide jacket since October, and has felt

perfectly well. The lateral deviation is now so slight that it is scarcely to be discovered. The left shoulder is still two degrees higher than the right when accurately measured. Forward bending shows considerable stiffness in the dorsolumbar region, and in this position the convexity of the spinal curve is broken by a slight hollow corresponding to the eleventh and twelfth

FIG. 3.



x Twelfth dorsal spinous process.

dorsal and first lumbar spines, but chiefly apparent to the right of the median line. This hollow is not accompanied by a corresponding swell on the left side, the contour here appearing perfectly normal. An attempt to gain an exact graphic representation of this depression was made by taking a cast of this part of the back in forward bending position. This cast was then sawed through transversely at a point corresponding to the twelfth dorsal spine and from the cut edge the appended tracing was made. The patient is gaining some lateral movement of the spine.

That the lateral deviation in the case reported was in part of muscular origin is evident from the clinical history. The rapid disappearance of the symptom under treatment almost to the point of completeness must prove this. There is no doubt that a loss of tissue of considerable extent upon the lateral aspect of one or more bodies may be responsible for lateral deviation in connection with a gibbus, as pointed out by Hoffa[1] and others. This deviation must remain permanent in so far as it is dependent upon bony loss alone.

On the other hand, the writer believes that there is evidence in this clinical history of the lateral situation of the lesion. This consists of the unilateral character of the pain, hyperæsthesia, and tenderness. In fact, on anatomical grounds it can be made to explain the preponderance of muscular spasm, which

[1] Hoffa. Lehrb. d. Orthop. Chir., 2te Ausg., p 282.

is presumably to be held accountable for the lateral bend. The external branches of the posterior dorsal nerves supplying the skin of that part of the chest involved in the hyperæsthetic and painful area innerve also the longissimus and sacrolumbalis muscles.

The view of Rédard[1] that lateral deviation *with torsion*, appearing in the absence of a gibbus, is due to static variations in the position of the pelvis or in the length of the limbs is inapplicable in this case because of the absence of torsion of appreciable extent. Aside from this, careful examination has shown these factors to be wanting in this patient. The absence of appreciable torsion, however, in the presence of a lateral bend of such marked extent was to the writer the more striking since his acquaintance with the investigations of Lovett[2] upon the normal spine. These he has been able, in part at least, to corroborate. According to Lovett, a purely lateral flexion of the normal spine does not exist. It is easy to demonstrate in the living subject that in lateral bending of the degree presented in the case reported an amount of torsion occurs which is perceptible and certainly in excess of that which, in this case, might have been latent, but was not to be estimated clinically. The temptation is strong, on this account, to believe that muscular spasm alone is insufficient to produce deviation of this particular character, but that there are required two additional factors: the lateral situation of the vertebral lesion, determining the predominance of the spasm to one side of the spine, and a sufficient and properly located bone destruction to permit such kinking of the column, even though it be unequal to impairing decidedly its weight-bearing function.

These factors would be found in the location of disease in the lateral mass of the vertebra, and some strength is lent to this view by the marked tenderness found at this point in the patient, as well as by the remaining deformity. The writer is, however, far from feeling justified in coming to this conclusion without anatomical evidence. Not being in possession of this,

[1] Rédard. Deviations de la Colonne vertebrale, Paris, 1900, p. 65.
[2] Lovett. Transactions American Orthopedic Association, vol. xiii.

the explanation remains purely hypothetical. It is conceivable that bone loss of comparatively limited extent and situated laterally and posteriorly, and especially if near either superior or inferior margin, might in the body of the vertebra have a similar effect. This situation might also account for the slight deformity of the spine which is still present.

In conclusion, a modification of older methods is offered for the application of plaster jackets in Pott's disease, and especially in cases presenting much lateral deviation. It is, in effect, a combination of three well-known existing methods: the extension from the head, the prone position in the hammock, and the oblique position of Nebel.[1] The extension from the head is adjustable by means of a screw clamp, so that the pull may be made in any direction from the horizontal to almost the vertical. By this means and through the cervical spine a more extended position of the upper dorsal segment can be secured, and by passing the bandages above the sling on which the patient is lying the jacket can be made much more efficient as an antero-posterior support. The tension of the sling being used to determine the amount of lordosis to be given the lower segment of the spine, the obliquity of the frame can be made to regulate the amount of counter-extension by gravity.

It will be found advantageous in cases with considerable lateral deviation to allow the patient to remain in the frame some minutes before beginning the application of the plaster. By this means considerable relaxation may be secured, so that, unless very unyielding, the lateral deviation may be overcome in great measure in one sitting. It has been observed, too, that under the influence of the extension, as well as the friction between the body and the broad muslin sling, lateral deviation being overcome by the hand, the correction is thus maintained during the application of the plaster.

[1] Nebel. Zeitschr. f. Orthop. Chir., Bd. iv., p. 104; also, Bd. v., p. 36.

AN ADDITIONAL CASE OF TRUE TYPHOID SPONDYLITIS.

By ALBERT H. FREIBERG, M.D.,
CINCINNATI.

It would seem at the present time that there is still doubt as to the nature of the symptoms presented by patients after typhoid fever and which have been grouped under the term "typhoid spine." By Osler[1] the condition is really considered a neurosis, by others perispondylitis; but since the paper of Lovett and Withington,[2] presenting, as it did, a case with undoubted loss of vertebral substance, a new aspect has been lent to the question. I make no apology on this account for presenting this report, more formal and complete, of a case mentioned in discussion at the last year's meeting, the less since I have in the meanwhile had the opportunity of further observation.

Case 92,606, an Italian boy, fifteen years of age, was admitted to the medical service of the Cincinnati Hospital, February 18, 1901. The patient's family history proves to be entirely negative, especially as regards tuberculosis.

The present illness of the patient began a few days before his admittance. He denied ever having been sick before. Upon his admittance his temperature was 102° F., and his case was considered a rather typical one of early typhoid. On the fifth day after his admittance rose-spots developed in profusion.

On March 5th it was noted that his temperature had had a typical typhoid range, reaching 103° to 104° F. daily. The case was unusual in no particular except that the patient was apt to be noisy, and was somewhat hard to control. The Widal

[1] Osler. Johns Hopkins Hospital Reports, vols. iv and v.

[2] Lovett and Withington. Boston Medical and Surgical Journal, March 29, 1900.

test made on March 9th was negative in its result. (I was mistaken about this in making my former report.)

The patient was allowed to sit up in bed on March 20th. Nine days later the patient was allowed to be on his feet, but complained of pain in the lumbar region, which continued after he resumed recumbency.

On April 3d he was put to bed again, because the pain in his back had grown much worse and more constant. The pain was severest at night, the spine decidedly tender to pressure; but there was no elevation of temperature.

By April 6th the pain in the back had grown so much worse that he could scarcely use the bedpan, and evidently was most careful to avoid any motion of the body. The pain became so great on April 7th that the patient required to be given an enema and to be catheterized on this account. Morphine in ordinary dose was only slightly effectual in quieting the nocturnal pain. At this time I was asked to see the patient by Dr. G. A. Fackler, in whose service he was.

I found him lying upon his back, evidently in great pain and very careful to avoid the least motion of the trunk. Pain was greatest in the back over the spine and to either side of it. It, however, radiated forward onto the lower part of the abdomen and downward toward the groins and upper parts of both thighs. He objected vigorously at being moved to permit the examination of the back.

Upon making such examination there was at once noted a decided projection backward of spinous processes involving the eleventh and twelfth dorsal and the first and second lumbar vertebræ, and at the height of which the greatest tenderness of the spine was found. In addition to this projection there was, however, a diffuse swelling extending both laterally and vertically beyond its limit, and all of which was also sensitive to pressure. This tenderness was, however, not of superficial character, but required fairly deep pressure to make it evident. The muscles of the back were rigidly contracted. The tendon reflexes were somewhat exaggerated at the knees, and there was slight ankle clonus. It was impossible to detect any impairment of sensation.

The patient was transferred to the orthopedic service on April 11th. A plaster bed was at once made for him, with the spine in an hyperextended position; upon its application he at once experienced great relief. This relief was, however, not complete. The patient complained of more or less pain during the next few days, although it was not severe, and did not interfere with sleep. On one occasion, while unobserved, he removed the bandages and plaster bed, casting the latter upon the floor. The pain immediately became so severe that he cried out and begged to have the plaster replaced.

On April 26th it was noted that he had been free from pain for a week; his spine was examined and found very rigid and still quite tender.

On May 8th a plaster jacket was substituted for the plaster bed and the patient was allowed to go about.

He was discharged from the hospital on May 31st upon his request, having been entirely free from pain. The examination which was made at this time still showed considerable stiffness of the spine, the bony deformity was unchanged; but the diffuse swelling of the soft parts had entirely disappeared.

I had the opportunity of examining this patient in my office in February, 1902. I found that the deformity at the lumbo-dorsal junction was about the same, although I had no exact measure of it. The spine was freely mobile, except in this region, where there seemed still to be a manifest restriction of motion. He had, however, had no symptoms of any kind since his discharge from the hospital. He had been working at his trade steadily, weighed more than he ever did, and was the picture of health.

Since Lovett and Withington's paper several cases have been reported in which the existence of posterior deformity has made it seem in the highest degree probable that destruction of bone tissue had occurred, though of limited extent. Such a case is that of W. J. Taylor.[1] Kuehn[2] reports one such case, and Neisser[3]

[1] W. J. Taylor. Transactions of American Orthopedic Association, vol. xiv.

[2] Kuehn. Münch. med. Woch., 1901, p. 23.

[3] Neisser. Centralbl. f. inn. Med., 1901, p. 438.

two, in which it was believed that bone destruction had occurred. In all of these cases, however, spontaneous cure resulted, leaving the spine, as far as I can determine, in a perfectly normal condition. Both of Neisser's cases continued for over two months, and in both of them fever was present until the disappearance of pain. Kuehn's case was characterized by the presence of a distinct lumbar gibbus which disappeared in one and one-half months, leaving no functional disturbance whatever. All of these cases have certain symptoms in common, such as the sharp and severe pain, the diffuse swelling, and the great tenderness upon pressure. Lovett and Withington's case and the one which I am reporting are the only ones, however, in which bony deformity remained long after the subsidence of subjective symptoms. In these cases, at least, it would seem impossible to avoid the conclusion that an inflammatory lesion with circumscribed loss of bone had existed. In these, however, such is the similarity of subjective symptoms, history, and physical evidence with the many other cases reported that I believe we are justified in attributing them to a local process of inflammatory nature rather than in looking upon them as of neurotic character. This would seem to be of some importance, even though all of the cases hitherto observed have resulted in cure without suppuration, especially so in view of the great relief which has been afforded by thorough immobilization of the spine in those cases in which this was done.

The question might be raised as to the nature of the destructive process in the spine, granting that such had existed. I take it that there is no reasonable doubt as to the nature of the preceding febrile disease in most of the cases at least. I think, however, that there is sufficient deviation in the spinal symptoms of these cases from the usual types of caries, more particularly in the manner of complete recovery, that they may easily and certainly be considered not tuberculous. If this is true we have but to consider them in the same class with the many sequels of typhoid in periosteum and bone.

FINAL RESULTS AFTER THE MECHANICAL TREATMENT OF POTT'S DISEASE.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

Orthopedic surgery as conceived in America comprises vastly more than the treatment of deformity, since the latter is often only a symptom or a remainder, but in the long run and in a rough way the spinal deformity of Pott's disease indicates the extent of vertebral destruction and gives a factor of the morbid process which may be located, mapped, and measured. It seems rather surprising, considering the amount of the material, the facility with which accurate records are made, and the length of time that these cases remain under observation, that the reports of results are so meagre.

The use of the flexible lead tape and card-board to register tracings of the spinal contour for permanent record is described in a paper[1] published in 1863 and seems to have been adopted soon after the invention of the Taylor spinal apparatus, in 1858, for patterns dating back to April, 1860, are still preserved. In the paper already mentioned the author speaks of having treated nearly one hundred cases by his leverage apparatus up to 1863; but it was not until 1866 that histories were regularly taken; even after this many cases failed to be recorded. Including the writer's cases, the records from private practice number nearly five hundred, usually accompanied by patterns of the deformity.

The extravagant claims at first put forth, especially in France, for the treatment by forcible correction, revealed such a lack of appreciation of the clinical behavior of the disease under mechanical treatment that the time seems favorable for a report

[1] The Mechanical Treatment of Pott's Disease of the Spine. Charles Fayette Taylor, M.D., Transactions of New York State Medical Society, 1863.

based on observations extending over a series of years. On studying the records it was found that one hundred and fifty cases had been observed or traced for five years or more, and of these there were forty cases with patterns and histories covering a period of from ten to thirty-seven years. These cases were under treatment for two years or over, but many were seen ten, twenty, or more years after their discharge, their condition noted, and patterns taken. They were all, except one case (IX.), treated by the application of the Taylor apparatus worn day and night, to which the chin-support was usually added if the disease was above the ninth dorsal vertebra. The patient was never allowed to stand or sit when the apparatus was removed for adjustment; active and fatiguing exercise was forbidden, and all shocks and jars, so far as possible, avoided. If the patient's condition was poor the hours of recumbency were increased and, if necessary, the recumbent posture was maintained for weeks or months. Recumbency was always in addition to brace treatment, never in place of it. It should be said that some of the cases were of long standing and had had previous treatment of various kinds. Many of the patients came from a distance and, owing to this and to other causes, their visits were infrequent. After the first year or two many came only once or twice a year, and in some instances this was insufficient. Home care as affecting the nutrition and morale of the patient and the management of the apparatus was a very important factor, and it was usually impossible to secure a good result unless some one person in the family was instructed and made individually responsible for the home management.

It would not have been difficult to select from the records forty or fifty cases showing excellent results, if the time limit had been placed at seven or eight years, but it was preferred to show everything without selection within the longer limit, and this paper may be regarded as a preliminary report upon the material in hand.

It should be remarked that the cases under treatment are oftener noted than those discharged, so that these observations comprise a large number of the long-continued and severe cases. Numbers of them wore the apparatus ten, fifteen, or more

years, though during these long periods the general condition was usually good after the period of active treatment, and the patient was often able to go to school and college and attend to his affairs, and only reported for examination once or twice a year.

These long periods of mechanical support were often necessary even when the patient was doing well and the result was good, as presently will be explained; again, there were cases which required and received close attention and made frequent visits for many years, and notwithstanding the ultimate results as to deformity were sometimes unsatisfactory. It will be seen that this method of treatment makes severe demands upon the patient and his family. It takes considerable strength of character and resourcefulness to carry out successfully through a series of years a treatment involving strict management both of the patient and of a mechanism which shall act continuously and in a definite manner upon his bony framework. In this sense these patients may be said to be selected, since they were able and willing to submit to prolonged treatment.

The forty patients were first seen in the period between 1861 and 1892; about half are known to be alive, most of them in early adult or middle life; several are married and have healthy children. Numbers have gone through college, studied a profession, or gone into business, and are leading an active life. In twelve cases there were one or more abscesses, of which two receded spontaneously, seven healed, two were still discharging when last heard from, and in one the result is not known. Three had paraplegia, of which two were cured and one improved. The age at the first visit was in twenty-nine cases under ten years, and in eleven ten years or over. The duration of the disease when the patient was brought for treatment was: in nineteen one year or less, in twelve over one and not over five, and in eight over five years; in one unknown. In thirty-four the disease developed before the age of six years, and in six, including one traumatic case, at six years or over. Excluding one case not treated, the result in thirty-three cases was cure of the disease and restoration to health and activity; six cases were improved. One case died of nephritis, twenty-one years after cure, at thirty-six years of age; one died of phthisis, aged

about fifty years, after wearing apparatus sixteen years with practically no increase in the deformity. This favorable showing as regards cure of the disease is largely due to the fact that most of the fatal cases occurred in the early years of treatment, and are therefore not included in this study.

The result as regards deformity is as follows: of thirty-nine cases treated there was, on comparing the last patterns with the first, a decrease of deformity at the point of disease in eight, an arrest of deformity in five, and an increase in twenty-six. In six cases the deformity was severe on beginning treatment, though in nearly all there were symptoms of active disease. In a few there may have been partial ankylosis of two or more vertebræ, as in Case XVII. In some cases where the deformity increased the increase was very slight or was counterbalanced by improvement in the secondary curves, and the final result was excellent or good, a slight stiffness or inconspicuous alteration of the normal contour being the only vestige. In other cases the result was a moderate increase, but in a considerable number, even of those taken early and with a slight or moderate deformity, the final result was a large rounded projection. Estimated in another way and taking into account the amount of deformity when treatment was begun, the result was good in nineteen, fair in seven, and poor in twelve.

On reviewing the cases it is seen that the most important factor in determining the progress of the deformity is the location of the disease, in other words the mechanical strains to which the diseased vertebræ are subject. The results in the cervical region are the best; cure is obtained with the least deformity and in the shortest time; many recover in two years. Second in point of curability is the lumbar region, including the eleventh and twelfth dorsal vertebræ, which resemble lumbar vertebræ in function. In these cases support is usually required for five years, and frequently much longer. Of the eighteen lumbar cases fifteen were cured and three improved. In three the deformity was arrested, in five it diminished, and in ten it increased. In ten the result was good, in three fair, and in five poor.

In the dorsal region, owing to the mechanical difficulty of

giving efficient support, and also to the fact that deformity here may assume larger dimensions and is more evident and unsightly, the results are least favorable. Of eighteen cases fifteen were cured and three improved. If we except those below the ninth dorsal vertebra there was increase of deformity in all, and in about half the increase was very marked. The result as to deformity may be considered good in seven, fair in four, and poor in seven. There are, however, records of a number of excellent results and a few of recession of deformity in the dorsal region in cases not observed long enough to be included here. This analysis would indicate that the location of the disease is an even more important factor in the progress of deformity than early treatment or excellence of management, and that in many cases, especially in the dorsal region, it would be wise to make more use of recumbency in addition to mechanical support. From a study of these and other cases it seems probable that ankylosis is rarer, later, and more limited in extent than has usually been assumed. The change of spinal contour according to posture is very striking, even in the old and badly deformed cases. If a tracing is taken with the patient sitting or standing and again lying prone the straightening is often striking, and if the prone position be maintained the improvement in outline may increase for ten, fifteen, or twenty minutes. Similar observations may be made with suspension. In favorable cases a large part of this temporary improvement may be retained by the leverage of the apparatus. In other cases this advantage is not maintained, and the bad deformity in process of time becomes worse. Still more striking is a considerable series of cases where, after long-continued treatment and the subsidence of all symptoms, the removal of support is followed by a gradual increase in the rounded projection without the appearance of any sharp projection or any return of spasmodic stiffness or other indication of disease. This occurs simply from the static conditions to which the spine is exposed and is similar in its nature to the commoner forms of round back in children and adolescents; Cases V., XII., XIX., XXXI., XXXII., and XXXVIII. are examples. In other words, after the spine is pathologically sound, it may

still be physiologically weak and vulnerable, and it may not be safe to dispense with mechanical support for a number of years. For this reason it is not uncommon to observe an increase, and sometimes a considerable increase, in the rounded projection after removing support. In several cases a marked rotary lateral curvature appeared late in the disease, sometimes after its cure, in other cases following an early lateral bending; the late cases are probably due to causes similar to those producing an increase in the cured kyphos; Cases I., XVIII., and XXI. are instances. In a few cases the deformity has markedly diminished after treatment was stopped, as in Case XXXVII.

The histories which follow are arranged with regard to the location of the disease, beginning above. Each history is preceded by a heading, giving the location and duration of the disease, the principal complications, and the result.

Case I.—Fifth and sixth cervical; three years' duration; cure in two years; secondary lateral curvature; at thirty years well, with no increase in deformity.

Fanny E., six years old, 1870, New York State. Pain in neck and down arms for three years, following measles; in last few months head has been noticed to turn to one side, and patient supports it. Brace with chin-piece applied, and patient did well in spite of an attack of whooping-cough. After two years patient was discharged cured and brace removed. At the age of sixteen there was a slight bending below the projection to the right, with rotation. At the age of thirty patient was married, in good health, and without noticeable deformity when dressed; was not noticeably short; had a healthy daughter, aged four.

Case II.—Seventh cervical; six months; cure in two years; recession of deformity after discontinuance of treatment.

Robbie F., three and one-half years, 1866, Illinois. Holds head tipped back, pains in neck, stomach, and sides. Has been treated for asthma. Wore brace with chin-piece for about two years with entire relief of symptoms. Deformity increased somewhat at first, but almost disappeared in the years following the removal of the brace. At the age of fourteen the pattern shows only a trace of deformity.

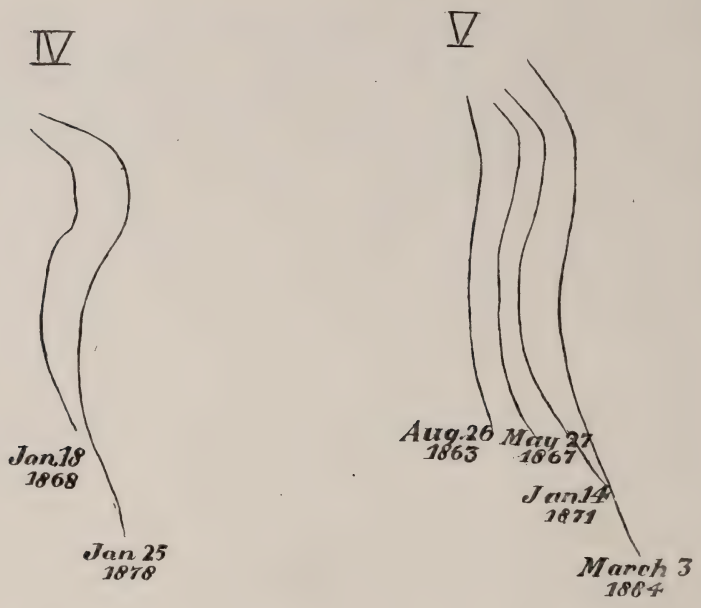
CASE III.—Cervical; cure; no deformity.

Carrie P., two years, 1869, New Jersey. Father died of Pott's disease. Condition bad; brought on pillow, head thrown back and drawn to one side; slight projection in upper cervical region. Brace with chin-piece worn, and patient made a com-

plete recovery without deformity. At the age of twenty-two neck and back well. No change in contour since last patterns, taken at the age of twelve. The length of time the brace was worn is not known, but it was not over a few years.

CASE IV.—First to fourth dorsal; eight years; recovery, with rounded bosse.

Mary B., nine years, 1868, New York. Has worn Dr. Wood's apparatus six years. Pain was relieved, but deformity progressed, and is now marked. After application of brace with chin-piece patient's health improved, but visits were infrequent, and deformity increased. An abscess appeared to left of lumbar spine, but it receded without opening. At the age of twelve patient passed through an attack of scarlatina. The chin-piece was discarded at the age of sixteen and the brace at the age of nineteen. At that time patient was much under medium height and had a large rounded kyphos. Her health was reported to be good.



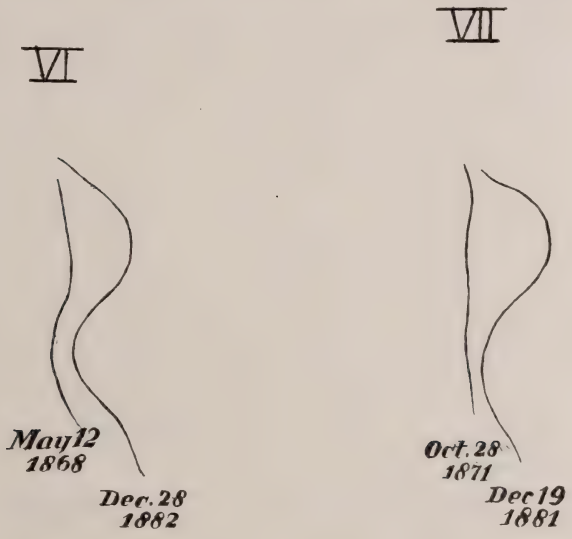
Case V.—Dorsal; one year; cure, with recession of deformity.

Minnie S., three years, 1863, New York. Pain in sides; can hardly walk. Apparatus applied with much relief, but patient did not improve rapidly, and chin-piece was applied two years later. Patient was discharged cured and brace removed in 1867; there had been considerable increase of deformity; no abscess. At the age of eleven patient complained of occasional pain and difficulty in holding up head, and brace and chin-piece were reapplied and worn about a year. At the age of thirteen she was in remarkably good health and the spinal column was flexible. At the age of twenty-four patient was five feet tall and presented a slight rounding only in the place of the former projection.

Case VI.—Sixth to eighth dorsal; one and one-half years; cure, with large increase in deformity.

Freddie McD., two years, 1868, New York. Father died of phthisis. Careful gait, gastralgia was promptly relieved after application of brace. At the age of eleven was still wearing

brace; health was excellent; never had abscess nor paralysis. Patterns taken at the age of sixteen show large rounded kyphos. It is probable that brace had not been worn for some time.



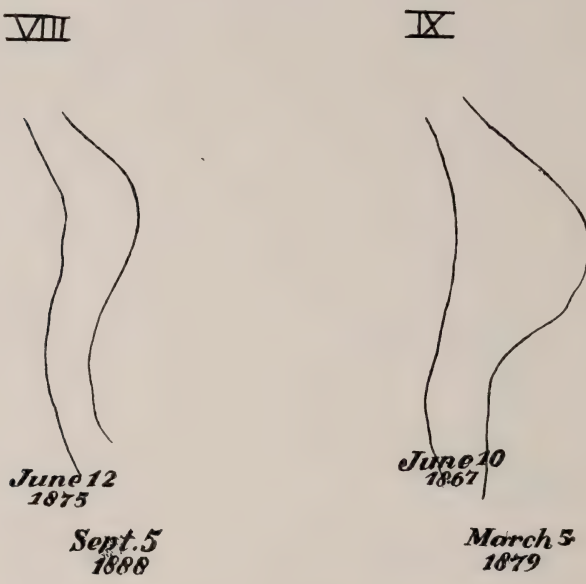
Case VII.—Dorsal; three months; relief; large increase in projection.

Charles D., two years, 1871, Brooklyn. Phthisis on father's side; remote. Condition poor. Relief on application of brace and chin-piece, was rather slow; but a year and a half later his health was excellent. After this visits were infrequent. At the age of twelve his health was fair; height $43\frac{1}{4}$ inches; still wearing brace. Small knuckle has increased to large rounded projection.

Case VIII.—Sixth to ninth dorsal; two years; cure, with rounded projection.

Mary S., six years, 1875, Virginia. Pains came on two years before, after typhoid; they are now in side and across small of back; cries at night. Application of brace afforded relief and patient's health improved, but visits were very infrequent and deformity increased. At the age of twenty patient was $55\frac{3}{8}$

inches tall, with a considerable rounded projection, but seemed well, and the brace was removed.



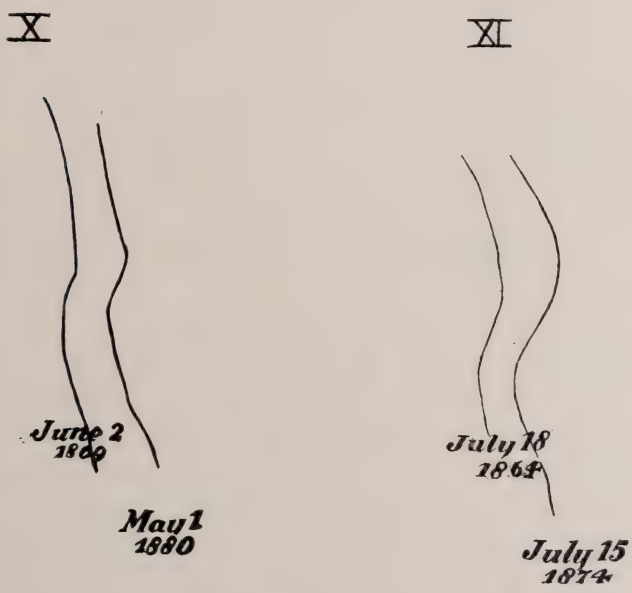
Case IX.—Sixth to twelfth dorsal; twelve years; no treatment; severe deformity.

James S., twenty-one years, 1879, New York. This patient was seen at the age of nine, and diagnosis of Pott's disease made before appearance of deformity, but treatment was declined, and he returned twelve years later with the pose and figure of the typical hunchback. He has had four abscesses; and one sinus still discharges. Health fair, but not so good in last four years as previously, when he rode horseback, fenced, and exercised without inconvenience. He did not come under treatment.

Case X.—Seventh to ninth dorsal; nine months; abscesses; at the age of nineteen apparent cure, with moderate increase of deformity.

Louisa K., four years, 1869, New York. Mother's sister died of phthisis; father's sister has Pott's disease. Peculiar gait and

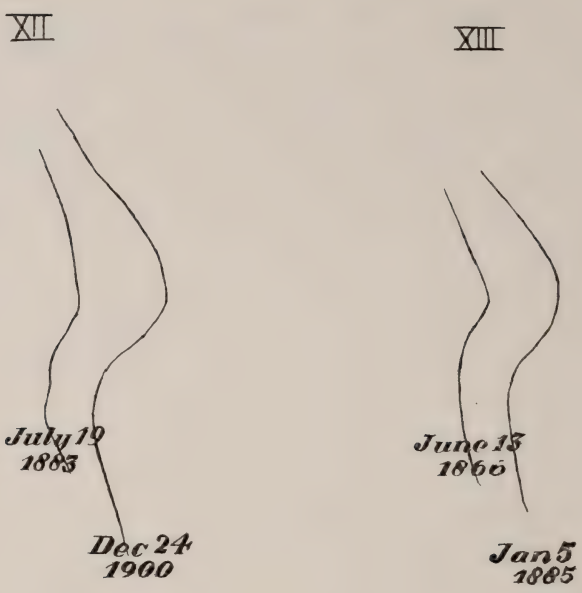
difficulty in stooping nine months ago; soon after pains in abdomen and sides; treated for gravel and heart disease. Brace applied; a year later left psoas abscess and contraction; evidence of disease at fifth lumbar. At the age of six pains after jumping rope. At the age of eight recurrence of abscess, which discharged for several years. At the age of nineteen height $55\frac{5}{8}$ inches; abscess closed for a year; no retraction at hip for nine months.



Case XI.—Seventh to tenth dorsal; two years; cure at home with slight deformity.

Lizzie O., three years, 1864, Canada. First cousin has Pott's disease. Disease began at eighteen months; gastralgia. Patient was seen and a brace fitted two years later. She wore it for ten years without returning, and now comes with a slight rounded deformity only. Patient had disease of the left knee, which was cured.

Case XII.—Seventh to twelfth dorsal; three years; cure, with increased deformity.



Floyd T., four years, 1883, Virginia. Has been wearing plaster jackets since first sign of deformity, over two years ago; deformity has increased considerably, and patient leans markedly to one side; breathing short. Patient was very faithful in attendance, and has been for several years free from symptoms; still wears jacket as protection. Is now twenty-three years old and has been three years in college. Projection is rounded; weight $111\frac{3}{4}$ pounds; sitting height, $29\frac{1}{8}$ inches; standing height, $61\frac{3}{4}$ inches; has never had abscess or paralysis.

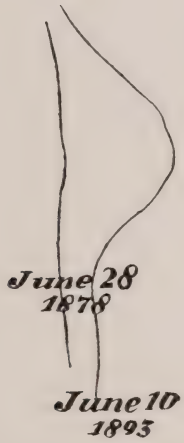
Case XIII.—Eighth dorsal; one and one-half years; paraplegia; cure, with rounded bosse.

Minnie L., six years, 1866. Considerable angular projection at eighth dorsal. Two years after coming under treatment she had paraplegia (sensation not affected), which lasted about a year and disappeared entirely. She wore the spinal apparatus about fourteen years, when she was discharged cured, in excellent health, with a considerably rounded bosse, not very noticeable when patient was clothed. In last note, eighteen and one-half years after coming under treatment and over four years

after leaving off brace, states that patient was twenty-five years old, 51 inches tall, weighed 81 pounds, and in excellent health. Spinal contour has improved in the last four years.

XIV

XV



CASE XIV.—Eighth and ninth dorsal; one year; cure, with dwarfism and large increase in deformity.

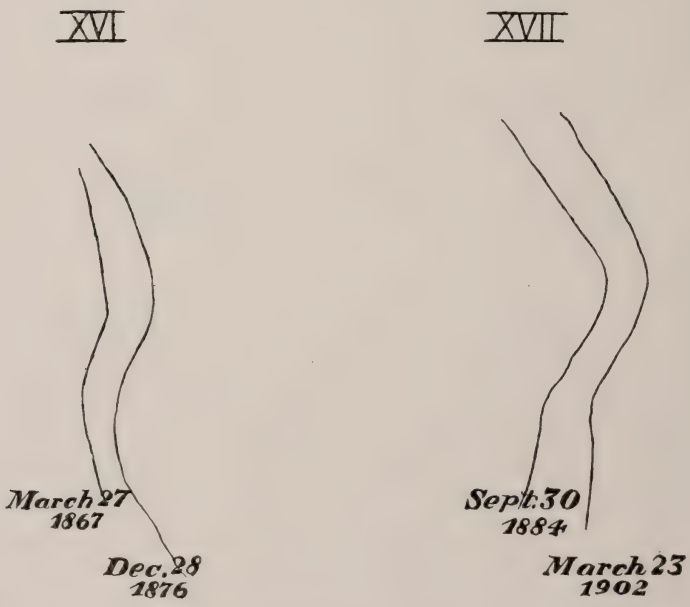
Eunice D., three years, 1863, Pennsylvania. This patient was faithfully treated for a great many years with relief, but she remained frail and very much dwarfed; the kyphos increased to a rounded bosse. She died at the age of thirty-six from nephritis; she was probably less than four feet tall. The notes on this case are very scanty.

CASE XV.—Eighth and ninth dorsal; six months or more; cure, with large bosse.

John C., two and one-half years, 1878, Missouri. Family history good; patient delicate; pain in stomach and knees; not allowed to walk or stand. The patient was seen at long intervals for fifteen years, during which time he was pale and delicate, and projection increased. At the age of seventeen he was 58 inches tall.

Case XVI.—Ninth and tenth dorsal; a few months; increase of deformity.

Emily H., three and one-half years, 1867, New York State. Parents died of phthisis. The brace was worn nine years, during the last three very inefficiently, with infrequent visits. During this time there has been a marked rounding of the lower dorsal region, without rational symptoms. This rounding continued to increase, as shown by tracings taken at the age of fourteen; no abscess or paralysis.



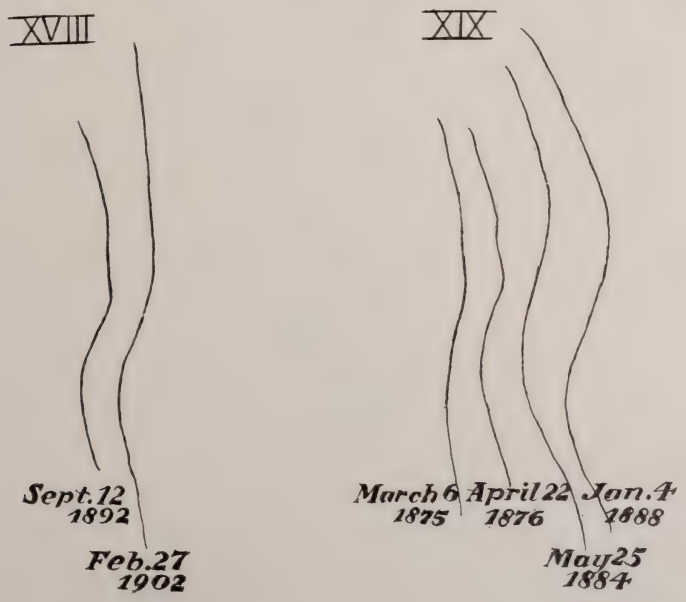
Case XVII.—Dorsal; twenty-six years; recurrence at the age of twenty-seven; paraplegia at the age of forty-seven; recovery.

Charles P., thirty years, 1884, Georgia. Family long-lived, but a brother and a sister died of phthisis. Pott's disease at the age of four; treated with Dr. Wood's appliance from the age of twelve to thirty, with much benefit; severe deformity; abscess of right thigh opened fifteen years ago, which discharged for a few months. He seemed well until three years before,

when he was injured in a cyclone; since then pain in back and side, and too miserable to attend to business; relief from pain, and restoration to health and activity. He wore a brace as a protection for twelve years. At the age of forty-seven, five years after discarding the brace, the patient had a recurrence, with paraplegia coming on slowly after a slight injury. The brace was reapplied and the patient is now walking about.

Case XVIII.—Tenth and eleventh dorsal; one and one-half years; cure; recession of deformity.

Mary McM., four years, 1892, Brooklyn. Father's brother died of phthisis. Peculiar gait was noticed one year ago; gastralgia three months. She now has agonizing paroxysms of pain every hour or two in abdomen, legs, calves, and running into left ankle; lateral deviation at knuckle, with rotation to the left. A brace was applied, with marked relief; pain was nearly gone in a few weeks, and disappeared entirely soon after. The patient was discharged cured after wearing the brace five years. At the age of fourteen the patient is 58½ inches tall, and is perfectly well; no abscess or paralysis.



Case XIX.—Tenth to twelfth dorsal; one year; cure; disappearance of deformity.

Gertrude W., five years, 1875, Pennsylvania. Family history good; gastralgia at times; right psoas contraction. Brace was worn, with great benefit, until the age of fourteen, when it was removed and patient discharged cured. Deformity increased after coming under treatment, but later diminished, and there was no knuckle at date of discharge. At the age of eighteen the patient was large and well nourished, and in good health. Rounding in the dorsal region had increased somewhat since leaving off the brace.

Case XX.—Tenth to twelfth dorsal; one and one-half years; marked increase of deformity on stopping treatment before cure; treatment resumed after five years and deformity checked.

Bessie D., three years, 1880, New York State. Family history good; pale and anæmic; plaster jackets were worn four months, during which time the deformity is said to have increased. A

brace was applied and the patient kept under treatment one and one-half years, when she was withdrawn. She returned in poor condition five years later, the deformity having greatly increased under leather jacket and corset. The brace was reapplied, with marked improvement in condition, and worn eleven years, until the age of twenty-one. At the age of twenty-four the patient measures 53⅝ inches, and weighs 80 pounds; health fair; no abscess or paralysis.

Case XXI.—Lower dorsal; four and one-half years; phthisis; cure and arrest of deformity.

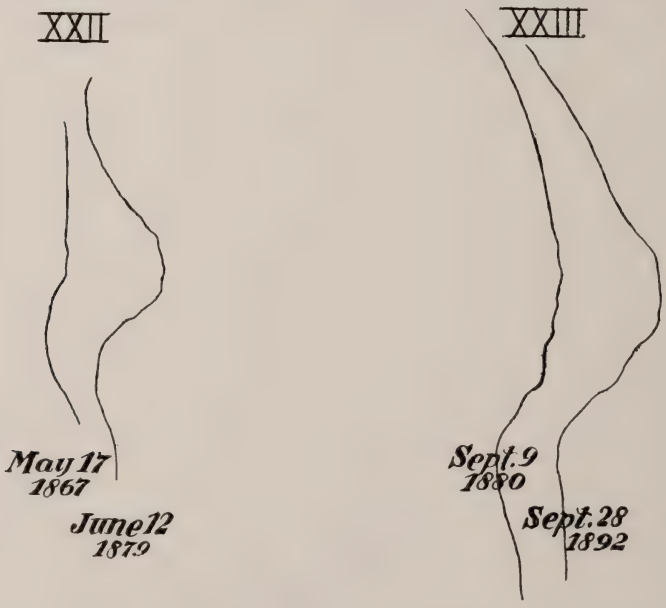
James McC., six years, 1886, Mississippi. A knuckle was noticed at the age of one and one-half years, and patient has worn plaster, felt, and leather jackets, but deformity has increased and is now considerable. The patient's delicate body

tilts to the right and sways backward; tottering gait; disease still progressing. A brace was applied, and at the age of seventeen the spine was considered well; but the brace was continued as a protection. The patient began to run down

and had physical and rational signs of phthisis, for which he was put under the case of Dr. Blake J. White, and later sent to Sullivan County. He recovered completely. At the age of twenty-two he is in good health, still wearing the brace, and practising dentistry. He has lateral curvature with rotation to the right above kyphos; height, $60\frac{3}{8}$ inches; weight, $89\frac{1}{2}$ pounds; no cough; health good.

Case XXII.—Lower dorsal; one year; large increase in deformity.

Frank B., four years, 1867, New York State. This patient wore a brace ten years. He lived at a distance, and visits were infrequent and directions not carefully followed.



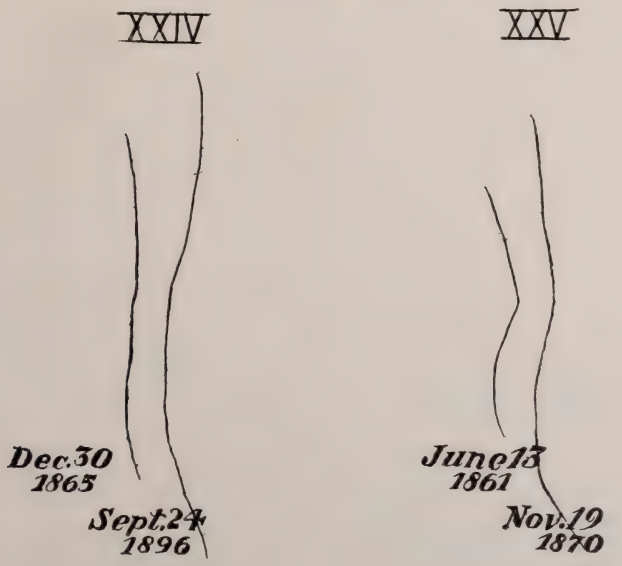
Case XXIII.—Tenth dorsal to second lumbar; one and one-half years; late paraplegia, with abscess; recovery.

Charles H., twenty years, 1880, Brooklyn. A brace was applied and the patient attended irregularly about three years, after which treatment was continued elsewhere. Eleven years later

he reported again, with considerable increase in kyphos. A new brace was fitted, but a year later the patient began to show signs of pressure on the cord, weakness in legs, exaggerated reflexes, etc. He was put to bed, and a year afterward two abscesses were opened near the kyphos. The patient soon after discontinued treatment, but paraplegia was improving. At the age of forty-two the patient is in fair condition, attending to business; has one sinus discharging.

Case XXIV.—Twelfth dorsal and first lumbar; six months; cured without deformity.

George A., five years, 1865, Brooklyn. Slight projection at last dorsal and first lumbar; health poor. A brace was applied, with prompt relief of symptoms. He wore the brace six or seven years and recovered completely. At the age of thirty-six he was examined by the writer. He had been married some years and had two healthy children of seven and eleven years. The patient was strong and well; 69 inches tall. His back was normal in appearance and movement. A critical examination showed a slight projection at the first lumbar.

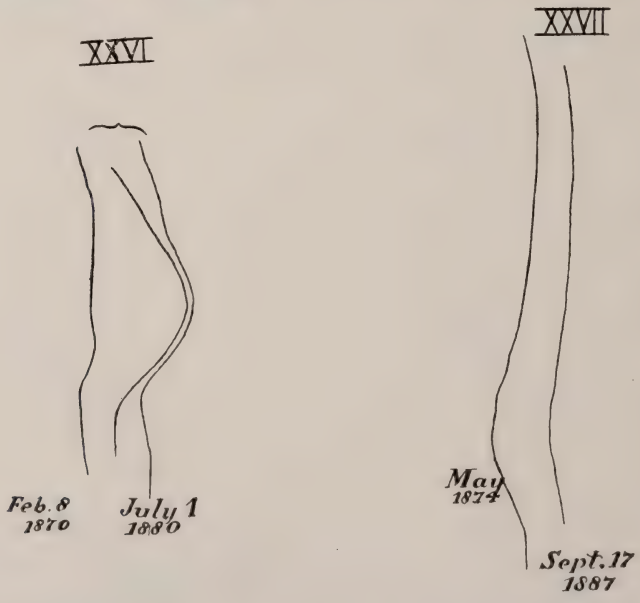


Case XXV.—Twelfth dorsal to second lumbar; one year; cure, with recession.

Elise de C., two years, 1861, New York. Apparatus was applied for one and one-half years, with no change in the deformity, after which it slowly receded, and two and one-half years later it had practically disappeared. The brace was worn seven years. A pattern taken at the age of seventeen, five years after its removal, shows a slight prominence at the old site. This patient was seen (not examined) at the age of twenty-seven by the writer, when she was of good figure and no visible deformity.

Case XXVI.—Twelfth dorsal to second lumbar; two and one half years; marked increase of deformity.

Mary L., four years, 1870, Connecticut. Phthisis on her mother's side; has right psoas contraction and gastralgia. At the age of fifteen the patient had large rounded bosse and stood 51 inches in stockings.



Case XXVII.—Twelfth dorsal to second lumbar; one year; traumatic; extreme disability; cure without deformity.

Mary H., forty-one years, 1874, New York State. She was picked up helpless on falling from a wagon one year before. She had had pain, numbness and twitching in left leg, and when she attempted to walk a month after the injury she had pain in the spine, small of back, and left groin; had been kept on her back since. She was brought in a coffin-like basket; her weight was 80 pounds. A brace was applied, with prompt relief, and the patient walked in four weeks. She wore the brace four years, and was then discharged cured without deformity. She was examined at the age of fifty-four, nine years after leaving off the brace, and the previous pattern was found to fit perfectly. There was a slight stiffness through the previously affected region; health fair; weight, 128 pounds. This case may not have been tuberculous, and the cure was doubtless aided by suggestion.

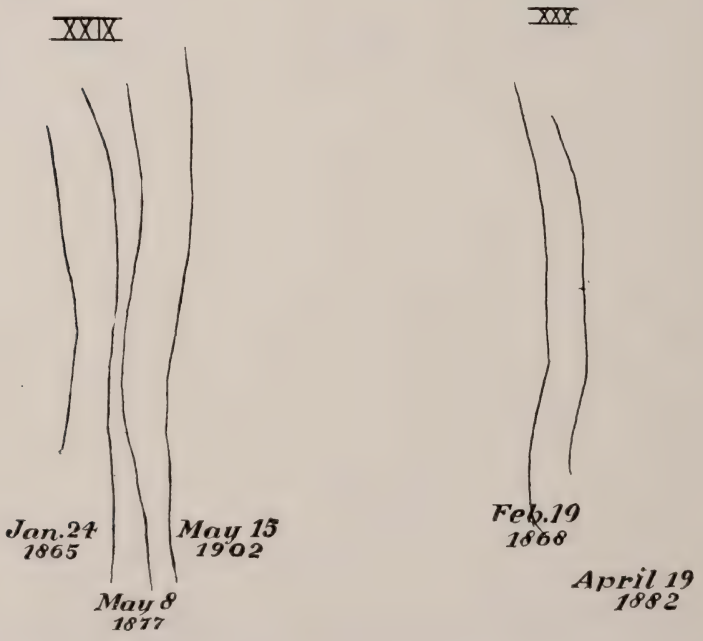
XXVIII

CASE XXVIII.—First lumbar; six months; cure, with recession.

Ellen M., four years, 1864, New York. There was a sharp knuckle at the first lumbar; lumbar abscess. She wore brace eleven years, when, being in excellent health and the deformity having entirely disappeared, it was removed.

Case XXIX.—First lumbar; cure without deformity.

Mary B., sixteen years, 1865, Brooklyn. She had pain in stomach several years, later pain in the back; obliteration of lumbar lordosis and distinct knuckle about the first lumbar. She wore a brace six years, with relief of symptoms and restoration to health. She married at the age of twenty-two, is still living in excellent health at the age of fifty-three, and has had six healthy children. A tracing of the back is shown, taken thirty-one years after discarding the apparatus. This patient has been frequently seen in the last few years, and no one would suspect that she had had Pott's disease. She is of fair height and without deformity. Critical inspection shows that back is somewhat shortened and broadened in the lower part.



Case XXX.—About first lumbar; one year; relief; death from phthisis sixteen years later.

Mrs. Henry B., about thirty-four, 1868, Illinois. Pain in back, side, and bowels began about nine months before, some

months after a normal labor. The patient experienced much relief from wearing a brace, and though in frail health and coming but once or twice a year, she was made very comfortable and deformity was arrested or somewhat improved after twelve years. Three years later her lungs became diseased, and after an illness of a year or so she died, probably of phthisis. Her last pattern shows a small increase in the projection, probably due to emaciation and failing health.

XXXI

Case XXXI.—First and second lumbar; one year; abscess; cure; increased rounding after.

Anna W., two years, 1871. Massachusetts. Phthisis on father's side; condition poor; gastralgia; abscess; symptoms relieved. She wore brace five years. At the age of nine she was remarkably well, with perfect figure; slight flexible kyphos; no evidence of disease. At the age of fourteen there was a considerable bowing out of previously diseased spine, but no return of symptoms. The abscess remained healed after the age of four.

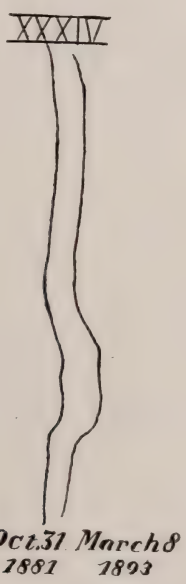
Case XXXII.—First to fourth lumbar; four years; cure, with increased deformity.

Albert C., nine years, 1879, New York. He was small, pale, and delicate; no pain. The deformity was held eight years, but after a trip to Europe kyphos increased a great deal. At the age of twenty the patient was in fair health and had been without brace over two years; no paralysis or abscess.

Case XXXIII.—Lumbar; a year or more; cure, with increase of deformity; recurrence after twenty-seven years; cure.

Fannie A., four years, 1865, Michigan. Family history good. Apparatus was applied and the patient remained away three years, afterward irregular in attendance and away for long periods. At the age of thirty-one she had been married eight years, had a daughter aged five, in good health. The patient had been active and in good health and had not worn the brace for many years, but for several months had felt miserable, and back and legs had felt so weak that she could scarcely go about. Pattern shows slight increase in the previous twelve years; bend

to left in lumbar spine; pain from coughing, sneezing, and laughing. There was swelling in the left iliac fossa the size of an orange; no previous abscess. The patient again wore the brace about one and one-half years, with relief of symptoms and restoration to health; abscess did not break. At the age of forty-one the patient and her daughter are living.



Case XXXIV.—Second to fourth lumbar; fifteen years; persistent suppuration; cure; some increase of deformity.

Jennie H., nineteen years, 1881, Illinois. Pott's disease at the age of four, and treated with brace in Chicago for several years; afterward was apparently well and went without support nine years. At fifteen the spine was again found diseased, and at eighteen an abscess appeared. She is now pale and has been unable to walk more than a few steps for over a year; two sinuses discharging. A brace was applied and the patient was walking in a few days. Later new sinuses appeared, but at the age of thirty-one they closed entirely. At the age of twenty-four her height was $56\frac{3}{4}$ inches. At the age of thirty-

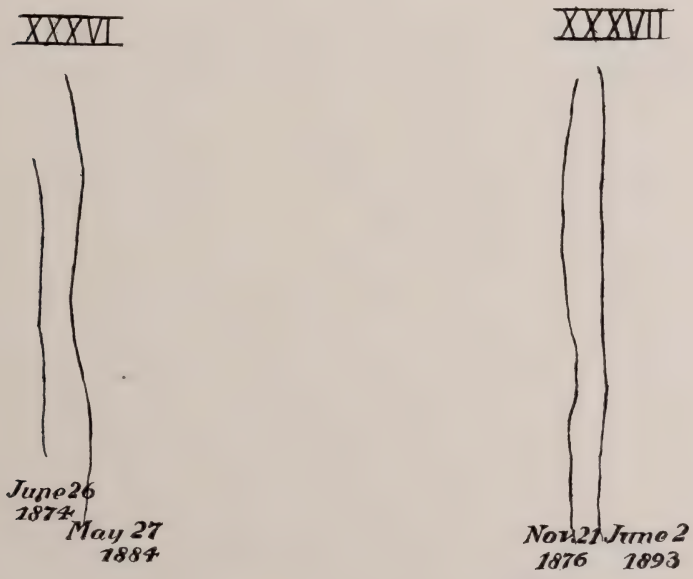
three the patient was in good health and still wearing the brace; sinuses remained closed.

Case XXXV.—Second to fifth lumbar; four years; cured; still wearing brace.

Mary P., twenty-one years, 1867, Massachusetts. Pain in right ankle; spinal stiffness after sitting. A brace was applied; no change in projection three and one-half years after the first pattern. Her visits were very infrequent and considerable increase in projection was noted at the ages of twenty-eight and thirty-four; no abscess or paralysis. At the age of forty-two the brace was left off; very marked keel-like projection of lumbar vertebræ, also some lateral deviation to the left. Patient well, active, and comfortable. At the age of fifty-two noticed some numbness in right foot and stiffness in stooping; back slightly more hollow above kyphos. The brace was reapplied and the symptoms disappeared, but patient, though well, is still wearing it as a protection at the age of fifty-five.

CASE XXXVI.—Third and fourth lumbar; six months; abscesses; cure; slight deformity.

Florence L., two and one-half years, 1874, New Jersey. She has gastralgia occasionally and strong right psoas contraction. A brace was applied; and abscesses appeared above the left ankle and on the right thigh the following winter, but the patient's health improved and the abscesses healed. She wore the brace seven and one-half years. At the age of twelve she was $54\frac{7}{8}$ inches tall and weighed $83\frac{1}{2}$ pounds—mother and father are short and small. The patient had grown tall lately and was plump. Examination showed some rounded projection in the lumbar region.



CASE XXXVII.—Third to fifth lumbar, eighteen years; cure; later recession of the deformity.

Annie B., twenty-two years, 1876, Illinois. The patient was treated elsewhere for eighteen years by supporting apparatus, and was probably well. Her health was poor; drank large quantities of brandy. Spinal support tentatively a few months only. She was seen again at the age of thirty-nine; married

seven years; never pregnant; still took brandy; very nervous; liver enlarged; constipated; spine well, projection having decreased.

Case XXXVIII.—Lumbar; one year; cure; neurasthenia.

Samuel G., twelve, 1877, Rhode Island. Family history poor. The disease followed measles; two sinuses discharging; does not walk or sit up. A brace was applied and the patient allowed to go about; great relief. The abscesses closed four years later. At the age of twenty the patient's spine seemed well; patient 62½ inches tall; in a state of spinal neurasthenia for several years. At the age of thirty-seven the patient is still suffering from nervous symptoms; but no signs of disease.

Case XXXIX.—Lumbar; fourteen years; double psoas abscess; cure.

Louis L., seventeen years, 1892, New York. He was treated with Dr. Knight's brace for ten years, when he was pronounced cured, and has been over ten years without it. He has been running down during the last six months, and now

has right psoas contraction and a fluctuating mass in the iliac fossa. A brace was applied, followed by speedy improvement. Soon after a large swelling in the left iliac fossa was incised near the anterior iliac spine and twenty-one ounces of fluid evacuated. In a month the sinus was discharging only a trace of clear fluid, and six months later it closed permanently. The patient was restored to perfect health, and after wearing the brace five years was discharged cured. He passed the Regents' examination, studied law, and was admitted to the bar while under treatment. At the age of twenty-seven he is practising law; height, $59\frac{1}{8}$ inches; weight, $103\frac{3}{4}$ pounds.

Case XL.—Fourth and fifth lumbar; six months; cure, with slight projection.

Charles G., three years, 1875, New Jersey. Lumbar abscess and marked right psoas contraction; less on left side. Pain in

stomach, and lately in right foot and ankle; apparatus and recumbency. Pain and psoas contraction subsided in a few weeks, years later, and abscess never opened. Now, twenty-five

years later, the patient is a practising lawyer; 68 inches in his shoes; weight, 145 pounds, and shows no abnormality dressed. There is some rounded projection, and stiffness at the fourth and fifth lumbar; some lordosis above this point. The legs, and trunk above kyphos, move freely in all directions. He can walk long distances, and is something of a gymnast; married, and has two healthy children.

To sum up: in thirty-nine cases treated in private practice by the use of the Taylor apparatus, where the cases were observed and the deformity recorded for ten years or more, it was found that:

1. The application of spinal support was nearly always promptly followed by the relief of pain and other acute symptoms, and by improvement in the general health.
2. The disease was cured in thirty-three, and in a considerable number the cure was practically perfect as regards health, figure, and function.
3. The result was good as regards deformity in half the cases; thirteen cases showed arrest or decrease of deformity.
4. As regards the final amount of deformity, the location of the disease was more important than any other factor, the cervical region being the most favorable, the lumbar next, and the dorsal the least.
5. It was necessary to continue spinal support in most cases long after the pathological cure, owing to the tendency to increase of deformity from static conditions.
6. Ankylosis is therefore later, rarer, and less extensive or less solid than is usually assumed.

DISCUSSION.

Dr. L. A. Weigel said that he had a case of typhoid spine under his care at the present time which seemed to show that there was actual bone disease and bone destruction. The patient was a boy of fifteen, who had had typhoid fever in January and had made an uneventful recovery from it. About

one month later he had developed the typical symptoms and attitude of Pott's disease. He was put to bed and kept recumbent for about three weeks. During this time the more acute symptoms subsided. He was then brought in a carriage to the office for a plaster jacket, and within three days he was able to walk to the office. At the first examination a large swelling was discovered in the right iliac region, which was hard and at one point somewhat softer and fluctuating. The thumb passed into a cup-shaped depression on the ilium, where the bone had evidently been eaten out. A radiograph was presented to show this point. These cases, he thought, should be looked upon as examples of infectious osteitis, and not simply as periostitis.

Dr. Shaffer said that he had been deeply interested in the cases reported by Dr. H. L. Taylor. Since 1882 he had been accustomed to divide the spine into four sections as regards not only the functional expression of symptoms, but as regards the prognosis. The first division was the cervical region. The second was from the seventh cervical to the tenth dorsal vertebra. This was the region of bad results, and here there was a normal kyphosis in the normal adult spine. There was a constant trauma of respiration, and the immobility of the spine in that section, owing to the ribs, prevented one putting the spine in a position in which traumatism could be reduced to a minimum. In disease of this region the patients should be told plainly of the difficulties and dangers.

Dr. Frank E. Peckham asked how long a child under twelve years of age would probably have to remain under mechanical treatment. He had a number of cases in which a gradual curve would appear or increase on removal of the brace.

Dr. Galloway said that all practitioners who had had much experience with life insurance work regarded with much suspicion the correctness of the diagnosis of typhoid fever in cases where the applicant reports having recently suffered from this disease and then dies of pulmonary tuberculosis within a year after the policy has been granted. It was probable that this

supposed attack of typhoid fever was nothing other than the constitutional disturbance marking the invasion of tuberculosis. Mention was made of a case of hip disease in which a practitioner told him that the local lesion had come on shortly after typhoid fever, but in which the supposed typhoid symptoms were almost certainly caused by the local lesion. He was convinced that some of the cases regarded as typhoid spine were simply examples of ordinary Pott's disease in which there had been an unusual degree of constitutional disturbance, and no typhoid fever had been present. He had seen at least one case of Pott's disease in which two distinct and separate regions of the spine were affected. The patient was a woman of about twenty-six years, with disease in the mid-dorsal region, and also a distinct kyphos in the lower lumbar region

Dr. Harry M. Sherman said it seemed quite certain that there were border-line cases between typhoid fever and tuberculosis as to the effects on the spine. The remarks of the last speaker were quite in keeping with a recent experience of his own. In one case there was a typical typhoid fever, and the diagnosis was confirmed by a positive Widal reaction. Within a few weeks the typical symptoms of typhoid spine developed. In another case, seen shortly afterward, a definite diagnosis had not been made, the physician in charge recognizing some spinal trouble, but not being positive with regard to it. The whole history, although vague, had led Dr. Sherman to apply the Widal test, but the result was negative. Later on a kyphos was developed, showing that the invasion had been one of rather acute vertebral tuberculosis, with probably some involvement of the base of either lung. Thus occasionally the orthopedic surgeon might be called upon to differentiate between tuberculosis and typhoid fever.

Dr. C. F. Painter said that one of the tabulated cases presented by him at the morning session had disease of the upper dorsal region. After about twelve years a lumbar kyphos developed. He thought he could recall at least two or three cases of double vertebral kyphos. He agreed with Dr. Gal-

loway and Dr. Sherman, that, in the absence of bacteriological findings of typhoid, possibly also with positive Widal reaction, one should be extremely cautious about accepting these cases as of common occurrence.

Dr. Henry Ling Taylor said that one of his tracings showed double disease involving the dorsal and the lumbar region. In making the diagnosis of two foci of disease, one should be careful to remember that when there is a kyphos in the upper dorsal region there is often a compensatory kyphos in the lumbar region, due to static conditions, and not indicative of disease at this point. He had known the diagnosis of Pott's disease of the lumbar region to be made more than once when there was no such disease present in that region, while Pott's disease of the upper dorsal region did exist, and had been entirely overlooked.

Dr. R. Tunstall Taylor remarked that when the Widal reaction was present once it was apt to be present in the same case for a number of years afterward.

Dr. A. H. Freiberg said that so far as he knew only one test had been made for the Widal reaction in his case, and that at an early stage of the disease, so that the negative result at that time did not have much weight. From the examination of the history of the case, however, the clinical aspect was certainly typical of typhoid fever. If the disease were a tuberculosis, one must admit that it was exceedingly acute at one period and had subsided in a singularly complete manner. There was not that degree of muscular rigidity, extending for a considerable distance above and below the lesion, which he would have expected if the disease had been vertebral tuberculosis.

With regard to the ultimate results in vertebral tuberculosis, he thought it must have been observed that in many cases, in spite of the most carefully directed mechanical support, the deformity continued to increase. Hoffa ascribed this to the fact that there had been more or less destruction of the grow-

ing centres on one side of the spinal column, so that no matter how much support was applied there was cicatricial contraction going on there which could not be controlled by mechanical means.

Dr. Henry Ling Taylor said, with reference to those cases where the deformity increased after cure, that this was very common, the pathological cure often being complete, and yet, in the course of years, if the brace were left off there would be a decided rounding without a sharp knuckle. For this reason he was in the habit of deliberately prolonging the support for several years in many cases of middle and upper dorsal disease. Even with the best judgment and the most conservative treatment the spine would sometimes begin to bend without recurrence of disease, and it would be necessary to reapply the brace to prevent the unsightly increase of deformity.

REPORT OF A CASE OF CLAW-HAND RESULTING FROM COMPOUND FRACTURE OF FOREARM CURED BY OPERATION.

By H. P. H. GALLOWAY, M.D.,
TORONTO, CAN.

A. B., aged eighteen years, when a young child sustained a severe compound fracture of the right forearm. Firm union without any bony deformity was secured; functional recovery was also entirely satisfactory. As the patient grew older, however, he began to experience difficulty in extending the fingers. This trouble gradually increased until finally it became impossible to straighten the fingers except when the wrist was strongly flexed. The thumb was not involved.

I first saw the patient on July 1, 1901. A scar on the anterior surface of the forearm opposite the junction of the middle and lower third of the radius marked the point where the bones had protruded when the compound fracture occurred in childhood. This scar was slightly depressed and firmly adherent to the underlying tissues.

When the wrist was flexed (Fig. 1) the fingers could be extended, but as the wrist was gradually brought into line with the arm, and then carried further into full extension, the fingers became fully flexed (Fig. 2) and could not be straightened either voluntarily or by passive efforts. Examination made it quite clear that the difficulty was due to shortness of the flexor tendons of the fingers. The tendons were long enough to permit extension of the fingers when the wrist was flexed, but too short when the distance between origin and insertion was increased by extending the wrist.

On July 4, 1901, I performed the following operation: A longitudinal incision three and one-half inches in length was made in the middle of the lower part of the anterior surface of the forearm. Through this opening the scar corresponding to the old compound fracture was first thoroughly separated from the tissues to which it was adherent. This, however, produced no effect upon the contraction of the fingers. The flexor tendons

FIG. 1.

FIG. 2.

FIG. 1.—Before operation. With the wrist flexed the fingers could be extended.

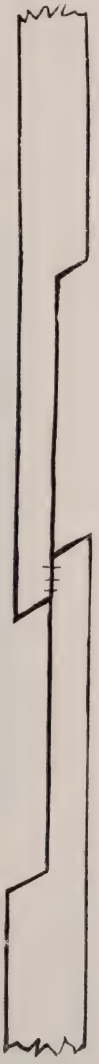
FIG. 2.—Before operation. When the wrist was extended the fingers could not be straightened.

of each finger were then carefully examined, and one after another they were lengthened to the extent that seemed necessary. The method employed to lengthen the tendons was that shown in Figs. 3 and 4. The tendon was transfixed, split longitudinally for one and a half or two inches, and the knife made to cut its way out on the radial side at one extremity of the longitudinal incision, and on the ulnar side at the other extremity.

The proximal and distal portions of the tendon were drawn past each other a sufficient distance to permit the finger to be

Fig. 3.

Fig. 4.



straightened while the wrist was extended, and in this position were sutured. The tendons of the flexor sublimus were chiefly

at fault, but in connection with two of the fingers it was necessary to lengthen the tendons of the flexor profundus as well. In all six tendons were subjected to the lengthening process. The segments of each tendon were united by a single anchoring suture of fine kangaroo tendon, more accurate adaptation being then made with catgut. A sheath was formed as far as possible by bringing together the subcutaneous tissue with catgut. For closing the external wound catgut was also employed, the sub-

Fig. 5.

After operation. Compare with Fig. 2.

cutaneous method of suturing being used. Plain sterilized gauze was the dressing. Finally the entire hand and forearm were encased in plaster-of-Paris, with both wrist and fingers in a slightly hyperextended position. Twelve days later the plaster dressing was cut along its radial and ulnar borders so as to convert it into anterior and posterior splints, and on uncovering the wound it was found soundly healed with the exception of a portion about three-eighths of an inch in length a little above the

centre of the line of incision. After employing slight passive motion the plaster splints were replaced, attempts at voluntary movements being postponed until several days later. At first the fingers were almost wholly paralyzed, but within a week of the first attempt at voluntary motion they could be moved quite freely, and in less than six weeks from the time the operation was performed the patient could write legibly and rapidly and could grasp my hand very firmly.

The present condition is shown in Fig. 5. With the wrist in line with the hand, the fingers are practically straight, while in regard to function the hand may be said to be perfect. As a matter of precaution a palmar splint is being worn on the hand at night to guard against any possible tendency to relapse.

DISCUSSION.

Dr. R. H. Sayre asked how far above the angular ligament these lengthenings of the tendons had been made.

Dr. Galloway replied, about one inch to one inch and a half above

WOLFF'S LAW AND THE FUNCTIONAL PATHOGENESIS OF DEFORMITY.

By ALBERT H. FREIBERG, M.D.,
CINCINNATI.

The correspondence between the structure of bone under normal and abnormal conditions and the calculations of graphic statics has been made the foundation upon which a doctrine of "functional pathogenesis" has been built. It has, however, formed also the basis of numerous attacks upon this theory. The theory of the functional pathogenesis of deformity and that of the functional shape of the bones have been made corollaries to the "law of bone transformation"[1] by its author, Jul. Wolff. The "law of bone transformation" is considered by its author as deriving its greatest strength from the remarkable resemblance existing between the internal structure of the normal human femur and the graphostatic diagram of a Fairbairn crane drawn by the mathematician Cullmann. This was given an outline similar to that of the human femur deprived of its trochanter major and viewed in coronal section, sustaining a load of 30 kilogrammes. This load is supposed to approximate that which is borne by the femur of an adult and to be applied to the crane in a manner consistent with the conditions in the human subject. The striking analogy between the courses of the bone trabeculæ in the frontal section of the femur and those of the trajectories of Cullmann's diagram was first insisted upon by von Meyer. The arrangement of the spongiosa in the sagittal section of the femur, corresponding to the "neutral plane" of the diagram, was foretold by Wolff in conformity with the demands of the graphostatic figure, and was substantiated by him later, anatomically. After the most painstaking study of the various bones of the body under normal and abnor-

mal conditions Wolff was able to formulate his "law," which might be translated as follows:

"Every change in the form and function of the bones, or of their function alone, is followed by certain definite changes in their internal architecture, and equally definite secondary alterations of their external conformation, in accordance with mathematical laws."

Before the promulgation of Wolff's law the generally accepted theory of the development of acquired deformity was that of Volkmann[2]-Hueter,[3] namely, that consequent upon muscular weakness faulty attitude was assumed, in consequence of which one side of a joint—*e. g.*, the external in genu valgum—was subjected to greater pressure than normal; the opposite side—the internal in genu valgum—sustained less pressure than normal. Assuming that during growth the normal development of the joint depends upon the maintenance of normal conditions of intra-articular pressure, it was explained that the increased pressure on the concave side interfered with the normal growth of bone or even caused atrophy of that bone already formed; while on the convex (internal) side the subnormal pressure permitted an overgrowth of bone. In spite of the fact that Mikulicz[4] and Macewen[5] showed, quite long ago, that these changes in the articular surfaces and epiphyses are not constantly present in genu valgum, but that the principal deformity exists in the diaphyses of the femur and tibia, most authors continued, nevertheless, to describe the pathogenesis of this deformity in conformity with the theory of Volkmann-Hueter. We shall later see how it is better explained by reference to Wolff's law and in agreement with the anatomical conditions present.

The first corollary which Wolff's theory has associated with it is that of the "functional shape."[6] The external form and internal architecture are determined by function solely. The internal architecture and external contour always correspond exactly, the latter representing, mathematically, simply the last curve uniting the ends of the various trajectories which make up the internal structure. The compact substance is to be regarded simply as a condensation of spongiosa.

From the theory of the "functional shape" it is an easy step to that of the "functional pathogenesis" of deformity. If the internal structure and external contour correspond exactly, and if they represent an adaptation to normal function only, then an alteration in static demands made upon the bones must be followed by the proper transformations of structure, both internal and external, and as the result of these we have the "deformity in the narrower sense." The deformity is therefore to be regarded as a physiological adaptation of structure to pathological static requirements, therefore to pathological function.

The agreement of the structure of bone, both under normal and abnormal circumstances, with mathematical laws, and in particular with those of graphic statics, is insisted upon by Wolff to such an extent that it has formed the basis of attacks upon the doctrine by Bähr[7] and Ghillini,[8] as well as others. It is their object to show that Wolff's mathematical conclusions are erroneous, and that therefore it is not permissible to make deductions from them regarding the structure of the bones in their normal or pathological relations.

We may well ask ourselves, on this account, whether mathematical proof of the competency of nature's design in bone structure has been brought by Wolff in Cullmann's drawing of the Fairbairn crane and the deductions following. What is required to enable us to construct the graphostatic diagram of the femur? It must be understood, as a preliminary in answering this question, that when "mathematical proof" is spoken of mathematical accuracy is implied. It is by no means enough to say that a striking similarity exists between the diagram and the bone whose mechanics we are trying to solve. There must be absolutely no divergence between the two.

In order that the mechanics of the femur shall be submitted to mathematical proof we must know every possible stress to which the bone is to be submitted under normal conditions, and these stresses must be expressed in figures. There must be possible of expression in figures the physical characteristics of the material used in the structure. But bones are evidently constructed of sufficient strength to withstand unusual stress

without giving way. This fact is demonstrated in every-day life. How shall we calculate this "factor of safety." We may believe, with Wolff, that the femur is burdened like a crane, or with his opponents that this is not so; but the fact remains that Cullmann's diagram is computed without mention of the muscular stresses upon the bone—without reckoning with the stresses put upon the bones in other positions than the upright. The great trochanter has been omitted from consideration altogether. This is obviously not permissible in a mathematical calculation, because it is always present, because it is the means of transmitting very considerable stress to the femur, and because its internal structure is evidently continuous with that of the upper end of the femur. I am assured by experts that the proper calculation of the construction of the femur upon exact mathematical lines is a work of great magnitude, requiring not only uncommon ability, but, on account of the enormous complexity of the problem, demanding a very large expenditure of time. To my knowledge, no such exact mathematical demonstration has yet been made. In addition to this, it is by no means certain that the "factor of safety" could be calculated; this factor might well make the mathematical solution impossible. Until exact mathematical proof is brought, however, there would seem to be no warrant for saying thus definitely that the external contour of a bone represents mathematically the last curve uniting the ends of the various trajectories which make up the internal structure—for assuming that the compact substance is to be regarded simply as a consolidation of those trajectories coming from the spongiosa.

If we are unprepared, however, to acknowledge that a truly mathematical demonstration of the structure of the bones has been made, we are, on the other hand, entirely unwilling to reject the law of transformation and its corollaries on this account without further investigation. In declining to accept the analogy between Cullmann's diagram and the structure of the femur as a truly mathematical demonstration of the latter we are, furthermore, far from saying that if such computation and graphostatic figure were made it would not coincide with the architecture of the bone. On the contrary, the structure of

the femur having been shown by many years of observation to be constant, the similarity between it and the mathematical figure is so striking as to make it seem reasonably certain that the trabeculæ do represent lines of force which nature aims to resist by the laying down of the bone tissue. This is, however, far from being mathematical proof, and, as it seems to us, does not afford justification for considering some of Wolff's other conclusions as "mathematical," however true they may be otherwise shown to be.

In view of the necessarily great variation in the factors of weight-bearing and muscular stresses which must exist in mammals other than man—because of the deviation from the erect position of the trunk, and because of the participation of the thoracic extremities in the weight-bearing function, it would seem likely that much information could be obtained from the study of their bones. Able and exhaustive investigation has already been made in this direction by Zschokke,[10] Schmidt,[11] and others. It has seemed worth while to independently repeat some of this work as well as to seek further for information in the structure of other mammalian bones. The femur has been chosen as the bone for further comparison, because of its size and static importance and because it has formed the basis for most of the conclusions which have already been drawn. In examining the femora, to be presently described, the method reported by Wolff[9] was employed. Sections were cut by hand by means of a saw. These sections were then photographed by means of the Röntgen ray, and from the negatives thus obtained the photographs were made which are herewith presented. As is the case with many radiographs, the negative is more instructive than the print made from it. In the smaller femora it was quite difficult to obtain prints the finer details of which would lend themselves to satisfactory reproduction.

In the description of the specimens which have been examined care has been taken to avoid as much as possible the repetition of details which coincide with the descriptions of Zschokke and Schmidt, above referred to. The following femora have been examined:

I. Ruminantia.
   (*a*) Ox.
   (*b*) Llama.
   (*c*) Sheep.
II. Carnivora.
   (*a*) South African leopard.
III. Primates.
   (*a*) Baboon (papio hamadryas).
   (*b*) Orang (simia satyrus).
   (*c*) Gibbon (hylobates).
      (Humerus of gibbon also.)

For the privilege of examining into the architecture of the femora of the orang and gibbon, as well as the humerus of the latter, I wish to acknowledge my indebtedness to the admin-

FIG. 1.

Femur of young adult steer.

istration of the Smithsonian Institution. Many of the other bones examined have been taken from the museum of the Cincinnati Society of Natural History.

Remarks on the Specimens Examined.

I. Ruminantia. (*a*) *Femur of the Steer.* (Fig. 1.)

Relative length of the neck is short. Capital epiphysis extends laterally to a point corresponding practically with the axis of the shaft. It is covered with cartilage to this point, and is to this extent a bearing surface. The angle made by the neck is about one hundred and twelve degrees.

Arrangement of trabeculæ is perfectly constant, and corresponds with the description of Zschokke and Schmidt. The spongiosa of the young adult is composed of exceedingly fine trabeculæ. As the age increases the trabeculæ become coarser and less numerous, so that the internal structure is more easily read. In old animals this change has continued, so that the difference between their spongiosa and that of the young animal is most striking (see Zschokke). The three most striking systems of trabeculæ seen are:

1. *Principal pressure* trajectories (converging from the mesial part of the head to the adductor compacta).

2. Trabeculæ from adductor and abductor compacta arch toward the axis of the bone, forming a series of gothic arches whose apices are in a straight line with the lateral boundary of the capital epiphysis. Such a series of arches also exists in the trochanteric epiphysis. Orthogonal crossings can be distinguished in the system of arches.

(*b*) *Femur of the Llama.* (Fig. 2.)

There is practically no neck to the bone. Capital epiphysis extends to the axis of the shaft, as in the steer, but the head is set more obliquely, making an angle of one hundred and twenty degrees with the shaft.

Although the animal is comparatively young (shown by imperfect union of epiphysis), the trabeculæ are comparatively coarse, their meshes large. The arrangement of gothic arches is lacking.

The marrow cavity extends comparatively high into the upper end of the bone. There are three systems of trabeculæ:

FIG. 2.

Femur of llama

FIG. 3.

Sheep.

1. Principal pressure trabeculæ.
2. Two systems diverging from the base of the great trochanter.
   (*a*) Toward the head.
   (*b*) Downward to the abductor compacta.

(*c*) *Femur of the Sheep.* (Fig. 3.)

In general shape and plan of internal structure we have the steer's femur in miniature. The angle of the neck is somewhat

Fig. 4.

Leopard.

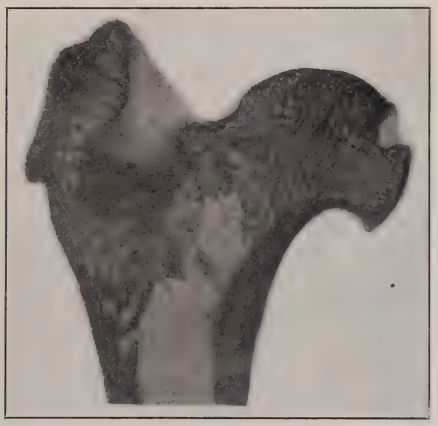
greater (one hundred and fifteen to one hundred and seventeen degrees), otherwise the same arrangement of capital epiphysis and gothic arches, though sometimes not so easily made out. Orthogonal crossings can in part be distinguished.

II. Carnivora. (Fig. 4.)

The only specimen examined was the femur of a South African leopard. The femur is characterized by its proportionately long, slender, and somewhat curved neck, which makes an angle of one hundred and thirty degrees with the shaft. The spongiosa is made of plates.

The femoral neck presents a triangular cavity of considerable size, and which in position and boundaries would correspond with Ward's triangle of the human femur. This is separated from the marrow cavity below by a small number of arches coming from the adductor compacta and corresponding to pressure trajectories. The crossings here are orthogonal.

Fig. 5.



Baboon.

Shorn of the trochanter major the outline is very like that of Cullmann's diagram; the internal arrangement is, however, very different.

III. Primates. (Fig. 5.)

(*a*) *Femur of Arabian Baboon* (*Papio Hamadryas*).

The bone is remarkably heavy for its size, and of very dense texture, so that it is difficult to saw. The neck is curved, and makes an angle of about one hundred and twenty-four degrees.

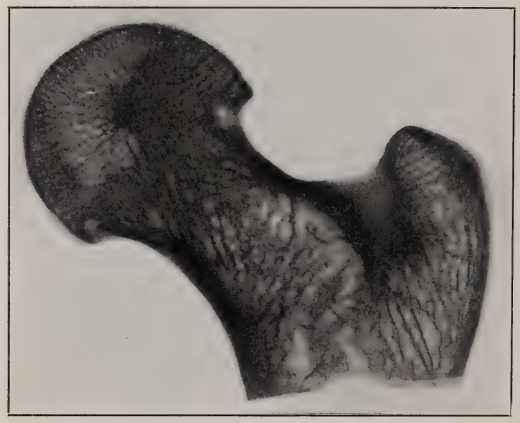
The trabeculæ are massive, largely in the form of plates. In the head they are fairly typical as principal pressure trabeculæ, and here show orthogonal crossings, with a few tension plates. There is here, too, a cavity in the neck, separated by

a few plates only from the cavity of the shaft below. The compacta of the shaft is relatively very heavy and thick, so that it is difficult to bring it into comparison with the amount of spongiosa.

(*b*) *Orang.* (Fig. 6.)

Both in external conformation and internal structure the upper femoral end is strikingly like the human. The angle made by the femoral neck is one hundred and thirty-five degrees. Both

Fig. 6.



Orang.

pressure and tension trajectories are found projected in a fairly typical manner, though the reticulum is much coarser than in man, the trabeculæ more plate-like. Orthogonal crossings can be made out to a limited extent. The condensation of spongiosa known as the "intermediary epiphyseal disk" (Recklinghausen), and which is constant in the adult human femur, is lacking.

(*c*) *Gibbon.* (Fig. 7.)

In general outline the upper femoral end greatly resembles that of the orang and man. The bone is remarkably light, however, its shaft very smooth and round, reminding one very

forcibly of the bones of larger birds. This comparison seems all the more apt upon bisecting the bone, because of the relatively large marrow cavity, with no spongy structure whatever save at the extreme ends. The angle of the neck is one hundred and forty degrees.

The section shows a spongiosa of lamellar character, in which it is extremely difficult, if at all possible, to find an arrangement in any way similar to that of man or, indeed, of any of the femora previously described. The neck proper is practically free from spongy structure, a cavity being here found which extends to the spongiosa of the head above and to that of the base of the great trochanter below. The cellular spaces of the spongiosa are relatively very large.

FIG. 7

Femur of gibbon.

FIG. 8.

Humerus of gibbon.

In view of the contrast in functional importance between the femur and the humerus in the gibbon, great interest must attend the comparison of their internal structures. The result of it is in accord with our anticipation. The internal structure consists of a lamellar spongiosa of comparatively coarse mesh, but in its general arrangement strikingly like that of the human humerus. This is true even to the existence of a place near the great tuberosity in which the spongiosa is quite rare, almost to the degree of being considered a cavity. The remains of the epiphyseal

line correspond both in direction and position, and the outline is simply a miniature of the human. (Fig. 8.)

In addition, it is to be noted that the gibbon's humerus is, in comparison with its femur, heavier and denser. On holding the bones close to a bright light the shaft of the femur is seen to be quite translucent; that of the humerus is not at all so. While the humerus is a longer bone, its density is disproportionately greater than that of the humerus. The volume of the two bones was determined by ascertaining their displacement of water. This was found to be 23 c.c. for the humerus and 22 c.c. for the femur. The weight of the humerus was 30.45 grammes against 21.67 grammes for the femur. Their ratio of weight is therefore 1.405, while their ratio of volume is 1.045. It is easily seen that the humerus is an organ of greater strength and usefulness than the femur.

In making a general comparison of the specimens in hand, it is well to remember that, in graphic statics:

1. The courses of the various trajectories are dependent upon the external shape of the structures, and conversely,

2. The number of the trajectories and their size depend upon the varying factors of weight and the character of the material.

It was remarked by Zschokke—and the statement is to-day equally true—that it was not possible to estimate the stresses in bone more than approximately up to that time, but that it was necessary as a matter of scientific reasoning to show, at least in some bones, that the trabeculæ truly correspond to the trajectories in direction and strength. Ten years have elapsed since this was written, but the task has not yet been performed.

Bähr, Ghillini, and the latter in co-operation with Canevazzi, have offered certain calculations in opposition, but these by no means present the solution which we seek. It would appear, therefore, that we are not yet provided with exact data to attempt a truly mathematical solution of the mechanics of the femur. If we cling too closely to the mathematical concept of bone structure we shall find it impossible, for example, to reconcile the structures in the upper femoral ends of the gibbon and the orang. We have here a striking similarity of outline, with an equally marked incongruity of internal formation.

If, however, we depart from the strictly mathematical notion and examine into the environment and habits of the gibbon and orang we shall find an admirable adaptation of structure to these and an explanation of the great variation in internal structure. According to Flower and Lydekker,* the gibbon is by nature an arboreal creature of great lightness, accustomed to maintain itself almost entirely by the thoracic extremities. Its movements are extremely rapid, and it is able to project its body through long distances in space in swinging from bough to bough and from tree to tree. When pursued on the ground and unable to reach a tree it moves forward chiefly on its pelvic extremities, and practically in the upright position, but so awkwardly and uncertainly that it is easily overtaken by man. The humerus of the gibbon, however, belongs to the extremity of greater power and use, and is manifestly of corresponding build. In the orang, on the other hand, we find great muscular power in the posterior extremities and comparative slowness in movement. We may similarly compare the femora of the leopard and the baboon, although possibly not so aptly, the former possessing wonderful agility and ability to make enormous leaps, the latter being contrasted by the great muscular development in proportion to its size. According to Zschokke, the femora of bears able and accustomed to maintain themselves frequently in the upright position possess great resemblance to the human in their structure. So in the ruminants, also, we find the modifications of internal structure in accordance with the shortness of the femoral neck, adapted, as this is, to weight-bearing purely rather than a large range of motion.

From the above we should be justified in concluding that while external conformation and internal structure represent admirable adaptation to use, their mutual interdependence is not so exact as the strictly mathematical concept would require. If we are to modify the doctrine of the functional shape of the bones to this extent, it is probable that the doctrine of functional pathogenesis must likewise be qualified.

Valuable evidence for the theory of functional pathogenesis

* Mammals, Living and Extinct.

should be found where the function of a bone has been changed for a considerable time without any gross solution of its continuity. It is believed that such evidence can be found in the specimen of old unreduced dislocation of the hip which is next presented, and in which we have the advantage of comparison with the normal femur of the same individual.

Description of Specimen of Old Unreduced Dislocation of the Hip, from the Museum of the Cincinnati Hospital (Series VII., No. 127 f).

The specimen has been in the museum for many years, and all clue to the history of the case has been lost. The board has wired upon it:

The Os Innominatum of the Side of the Luxation. This shows the acetabulum to have been unoccupied by the femoral head for a long time. The floor has become roughened by the presence of small osteophytes. The acetabular cavity appears to have become smaller by the thickening of its rim and the formation of new bone in its floor. Just behind the acetabulum there is seen a rather flat, though slightly concave, bone mass of roundish outline, with a diameter of 5 to 3.5 cm., and elevated 0.52 to 0.53 cm. above the surface of the surrounding bone. This rests upon a buttress of bone thrown out from the ilium and ischium. It is evidently the representation of an attempt at forming a new acetabulum.

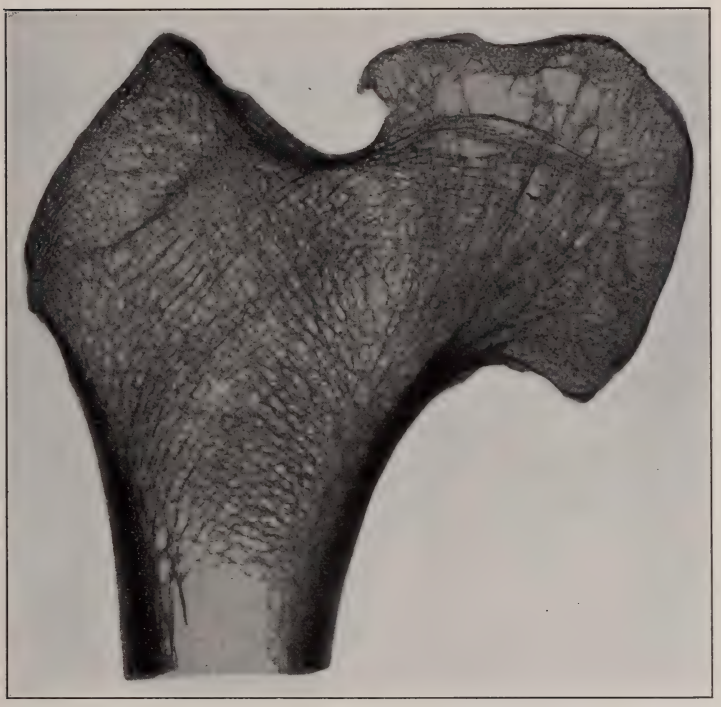
The Upper End of the Right (Dislocated) Femur. (Fig. 9.) This has been sawed through about 8 cm. below the tip of the great trochanter. It has also been bisected in coronal section.

The Upper End of the Left Femur (Normal). (Fig. 10.) This has been sawed through at 6.7 cm. below the tip of the great trochanter, the cut just striking the tip of the lesser trochanter. It has also been bisected in coronal section. Upon joining the halves of the right (luxated) femur and attempting to fit the head, in its dislocated position, into the new acetabulum, it is readily seen that its superior surface—that which formerly was the chief means of transmitting weight—was no longer a bearing surface, but that the joint bearing under the new conditions

was displaced downward. It can be seen that the position of the femur could not have been maintained by the bony socket alone, but that the soft parts must have played an important if not the chief rôle in this.

The examination of the femoral head shows at once that it may be divided, functionally, into an anterior and posterior,

FIG. 9.

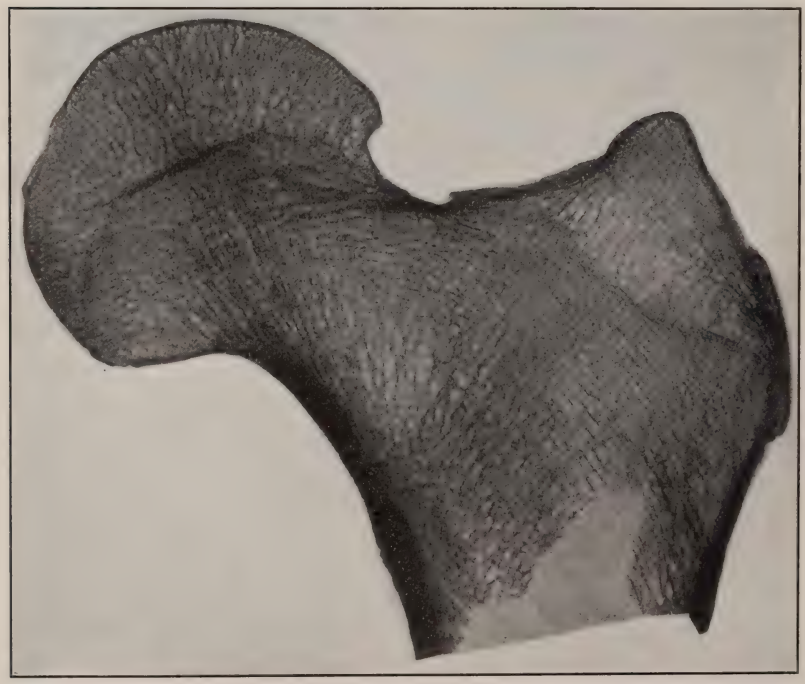


Dislocated femur.

an upper and lower segment. The anterior segment is characterized by the smoothness of its internal contour and its roundness when compared with the posterior segment, which is rough, presenting irregular elevations. The margin of the head in the posterior segment is considerably mushroomed; this is not so in the anterior. The corticalis of the posterior segment is very

thin, and in one place has disappeared, so that the spongiosa is exposed. (This is not broken.) The head is no longer nearly spherical, but bullet-shaped, with a rounded apex in the line of the cervical axis. Crossing the anterior segment is a slight ridge which divides the anterior segment into an upper and a lower portion. The upper portion is somewhat rougher and flatter than the lower, and this division will be later referred to in the description of the section.

FIG. 10.



Normal femur from the same subject.

From the anterior half of this femur a section was cut varying from 3 to 4 mm. in thickness. A similar section was taken from the left femur. Through a mishap the spongy portion in the lower portion of this section was broken. The spongy tissue should be intact through the section. The following measure-

ments show in part the decided differences existing between the right and left femurs: Diameter from the circumference of the head to the base of the trochanter major: right, 8.75 cm.; left, 10.40 cm. Height of trochanter major from tip to base: right, 4 cm.; left, 4.46 cm. Greatest thickness of adductor compacta: right, 0.58 cm.; left, 0.44 cm. Greatest thickness of abductor compacta: right, 0.57 cm.; left, 0.34 cm. Angle between the neck and shaft: right, one hundred and twenty-two degrees; left, one hundred and twenty-seven degrees.

The following changes of external configuration may therefore be noted: (*a*) General diminution in the size of the bone; (*b*) diminution of the angle between the shaft and the neck; (*c*) alterations in the shape of the femoral head, as before described.

The transmutations of the internal structure are, however, more striking, and when taken in conjunction with the above-mentioned alterations of external contour, and in view of the changed conditions of stress from both weight-bearing and muscular action, make it possible for us to present a rational interpretation. These transmutations may be described as follows:

1. The cancellous tissue is of looser mesh than that of the left femur.

2. The tension trabeculæ proceeding from the abductor side are shorter in length, but also of changed (shortened) radii. The pressure trabeculæ, however, seem, if anything, more numerous and of greater strength than those of the left femur. As the result of this, Ward's triangle, which is ordinarily constituted by the convergence of two well-defined groups of trabeculæ coming from the upper part of the head and region of the great trochanter, respectively, has disappeared entirely.

3. The most conspicuous change of the internal composition is, however, to be observed in the head. We have here a considerable cavity in the spongy tissue, corresponding in position to the flattened part of the head, and which is traversed by a few bone plates. The antero-posterior depth of this cavity is 2.50 cm.; its width in the coronal section is 2 cm. The antero-posterior diameter of the head at this part is 3.40 cm. The floor of this cavity corresponds exactly with that ridge on the

anterior aspect of the head which divides this into an upper and a lower segment.

4. Upon examining the anterior and posterior halves of the bone, it is seen that the cancellous arrangement in the anterior segment is more compact.

Unfortunate as it is for the present inquiry that no record is left to show the exact amount of motion and strength possessed by this dislocated hip, the changes of its structure nevertheless correspond strikingly with the requirements of Wolff's law. The atrophy of the unused parts, and the condensation of those bearing increased stress, as well as the decided change of external conformation, are sufficiently manifest as to impossibly escape notice. Equally evident, however, are the encroachment upon the original size of the acetabular cavity by the formation of new bone, and the irregular surface of the unused part of the femoral head for the same reason. I take it that we have here conditions analogous to the so-called hypertrophy of the inner condyle in genu valgum, and that we are dealing with an increase in cubical dimensions as an accommodation to altered conditions of space. If this increase of cubical dimensions is to be so regarded it must be looked upon as a result of the deformity and not as one of its causes. Its functional rôle in resisting stress can, from its physical characters, be considered insignificant.

From the researches of Wolff, Zschokke, Schmidt, and others, as well as from the observations herewith presented, it is believed justifiable to conclude as follows:

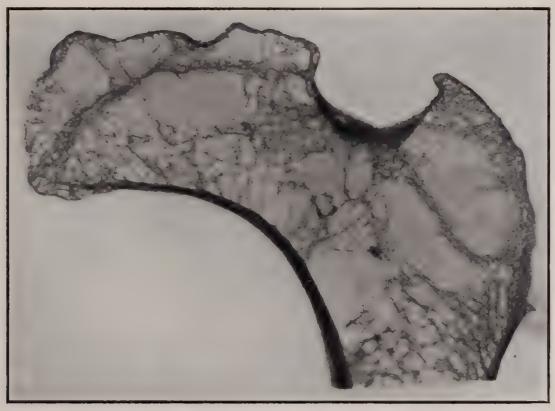
1. The strictly mathematical concept of Wolff's law has not yet been justified by demonstration.

2. Save in their mathematical aspects, the statements of Wolff's law and its corollaries may be accepted as being in agreement with observations hitherto made.

3. If we accept the foregoing statements it does not follow that we must make use of the so-called "functional methods" in our therapeutic endeavors; they are to be chosen not from theoretical considerations only, but for reasons of expediency and practicability.

[NOTE.—In the discussion following the reading of this paper there was presented the right femur of an idotic woman, thirty-five years of age, by Dr. R. Tunstall Taylor, of Baltimore. The specimen is of such interest, and is believed to be corroborative to such a degree, that, with Dr. Taylor's kind permission, the case and section of the bone are herewith briefly presented. The subject from whom it came was a paralytic, considerably deformed, having severe scoliosis and being greatly underdeveloped. The fibula of this subject was about fifteen inches long and somewhat greater in thickness than a good-sized knit-

FIG. 11.



Section of femoral head of a paralytic idiot, aged thirty-five years. (By permission of Dr. R. T. Taylor.)

ting-needle. The pelvis was likewise deformed. The femur is extremely light in weight. Its extreme length is 38 cm.; the coronal diameter of the shaft at the middle is 1.3 cm. The head is greatly flattened from above downward, as may be seen from the section. The surface is marked by several deep grooves of antero-posterior direction. Otherwise the bone is of fairly normal shape, with the exception of the trochanter minor, which forms a quite long spur projecting anteriorly, leaving a deep groove between it and the upper part of the shaft. The radiogram of the section of the upper extremity of this femur is almost self-explanatory. (Fig. 11.) Vestiges of the normal inter-

nal structure are apparent. Such are the intermediary epiphyseal disk, some of the principal pressure trajectories, and some of the arches as well. The upper end of the bone is, however, merely a hollow shell, and expressive, it seems to me, not only of imperfect development, but of general atrophy also. As far as can be ascertained, this person was never able to maintain the upright position.]

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A DISCUSSION OF WOLFF'S LAW.

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We should feel much indebted to Dr. Freiberg for bringing the subject of Wolff's law, with its subordinate corollaries, before this Association, if for no other purpose than to promote a discussion of the thoroughness of its proof and its apparent impregnability.

To those of us who were fortunate enough to have read Wolff's first paper and his final article in the *Archiv fur klinische Chirurgie*, or Freiberg's abstract in the *Annals of Surgery*, fruitful points of view were found for study of the etiological, pathological, clinical, and therapeutical problems that come under our observation.

To those of us, on the other hand, who are not familiar with this work, or who still cling to the theories advanced by Volkmann, Hueter, Roser, Lorenz, and others, known as the "pressure theory," blaming "superincumbent weight" and "atrophy" incident to it with many if not all of the deformities seen, Dr. Freiberg's present paper will at least make us think how much or how little we can apply these preconceived ideas to the pathogenesis of deformity, and how much we are indebted to Wolff for an entirely new aspect of the subject.

Many difficulties confront the majority of us in the study and proof of this law.

First, from a mathematical standpoint, how few of us are in a position to handle, as a well-known physicist put it to me, "the vector analysis, involving the N different variables," entering into the problem of joint motion, use, and function, there being no by-law rendering a Ph.D. acquired in higher

mathematics or mechanics as an essential to fellowship in the American Orthopedic Association.

However, by means of such a "liberal education," to quote one of Dr. Gilman's favorite expressions, we would be in a position to discuss the mathematical and mechanical problem involved in the pressure, shearing stress, and tension trajectories of graphic statics in three dimensions, and Cullmann's discovery of the analogy in arrangement of the trabeculæ in the bone spongiosa and corticalis to his well-known drawing of the crane.

To most of us the mathematical side of this law must remain simply a point of interest and one which we will not try to prove or disprove.

Second, in regard to the pathological proof.

Dr. Howard Kelly once said to me, "You orthopedic surgeons have no mortality in your cases!" This, in comparison with some of the other specialties, is in a sense true, and hence we have fewer opportunities to study the diseases or affections we are called upon to treat, post-mortem, pathologically than (shall I say?) some of our luckier brethren.

Even granting that our medical museums are well stocked with orthopedic preparations—which, alas! is far from the case —how few curators (or surgeons who own these necessarily valuable specimens) are keen to allow them to be cut into sections to study the trabeculæ of the spongiosa or measure the hyperplasia or diminution or the corticalis.

Third, from our training, reading, and preconceived ideas, how few of us are willing to discard entirely the theory of pressure or superincumbent weight, especially in regard to the etiology of scoliosis, when most of our American authors at the present time—notably Bradford and Lovett, Whitman, Young and Judson, and such foreigners as Volkmann, Roser, Lorenz, Hoffa, Schreiber, Rédard, and others—have advocated it; and many by experiment on the cadaver or vertebral column have produced a true rotary lateral curvature by superincumbent weight alone when function was, of course, a thing of the past. Whitman's is the only American text-book referring to Wolff's law, and this in an isolated way, and not applied to the diseases themselves.

Now it will be my aim to discuss Wolff's final paper more in detail, as upon it I have understood from Freiberg's abstract that his paper is based.

If we consider the mathematical postulate involved in Cullmann's tension and pressure trajectories of graphic statics, cannot we well question their accuracy if we consider the manifold directions and amount of force (*i. e.*, vectors) involved in the function, for example, of the hip-joint, with its numerous muscles and their dissimilar attachments and modes of action? Apropos of this, Wolff says himself, on page 837 of the article in question, replying to the criticisms of Hollander and Korteweg: "I also concede that the conditions in the live organism are much more complicated than they can appear in the mere observation of Cullmann's drawing. Many anatomical and mathematical researches will be necessary to complete our knowledge in this direction."

Atrophy undoubtedly, in its true sense, as shown in sections of diseased or morphologically changed bones and joints, does not take place, but an adaptive thickening of the corticalis and condensation of the spongiosa by transposition of burden-bearing; but can we agree absolutely with Wolff when he says this "cannot be due to pressure, but must be due to function?" Cannot pressure produce a condensation and thickening of bone as it does in the skin, as is shown by the callosities in the latter from pressure?

On pages 853 and 854 Wolff conclusively disproves that atrophy is the result of these conditions; and in his work in 1870 and Roux's observations on the "relation of the external shape to the internal architecture being dependent on the demands made on the part," their views were thoroughly substantiated by pathological evidence. But for the reason that he has found instead of an "atrophy," as the pressure theorists have called it, an osteosclerosis on the concave side of deformities, rendering this situation more suitable for "*burden-bearing*," for him to conclude that function has done it all and superincumbent weight none of it, seems to me open to question.

While no one will question, after the examination of pathological specimens, that the concave side of a bone or a series

of bones acquires a density or strength adapted to the burden-bearing required, can we say positively—leaving out the mathe, matical inferences—from the evidence (pathological) at hand, or as the logical conclusion of his arguments, that function is

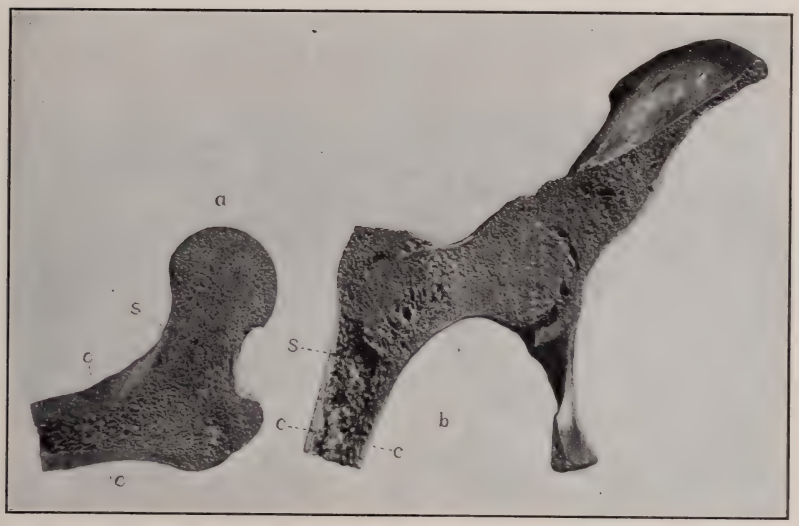
FIG. 1.

Sections showing deformity following mal-union of the humerus. *c*. Thickening of the cortex at the concavity. *s*. Thinning of the cortex and greater porosity of the spongy portion of the convexity of the deformity.

the only stimulus to this change unless we include both burden-bearing (otherwise called superincumbent weight) and pressure, to which he later adds accommodation to space, under the generic name of function?

In the third chapter, headed "Clinical Observations," Wolff goes on to state that because we find pathologically that both the internal architecture and configuration are changed, and the external form as well, in deformities, that these deformities are caused by and are the result solely of a functional transformation of bone, whether in the "narrower or wider sense of the term;" yet he goes on to state that "the shape of the bones and joints of the deformed part represents nothing else

FIG. 2.



Sections of femora: (*a*) Normal; (*b*) tuberculous ankylosis. *a*. Cortex thick at *c c*, with regular trabeculæ in spongiosa at *s*. *b*. Cortex thin at *c c*, with irregular trabeculæ in spongiosa at *s*.

than the expression of a functional accommodation to the faulty *static demands* made upon it."

It seems to me, therefore, that the "static demands," or what we are wont to call vicious or unavoidable attitudes, cause deformities, and the functional bone transformations simply intensify them.

He mentions—and we are all familiar with cases of beginning scoliosis without bony change—and would anyone of us expect

either the formation of the scoliotic wedges or torsion in the vertebræ if superincumbent weight were removed by the habitual recumbency of such an early case of lateral curvature? and, *vice versa*, in such a case, if superincumbent weight were allowed to act continuously, which of us would not fear the pathological changes named?

Further, in a severe case of congenital talipes equino varus, before the child has walked we consider it a deformed foot, but there may be no bony change. Wolff says the transformation of bone constitutes deformity, and this transformation is necessary to function. This we can accept generally, but can we

FIG. 3.

Sections showing ankylosis of vertebral bodies following tuberculous spondylitis (Pott's disease). No marked change in thickness of cortex to meet new functional demands.

agree with his statement that in all cases the pathogenesis of deformities is functional?

Wolff is correct, so far as we know, in that there is no pathological evidence of an osteomalacia or bone softening in the scoliotic deformities of adults and the bed-ridden; but cannot we find muscular contractures from various causes producing bone pressure, with ultimate deformity?

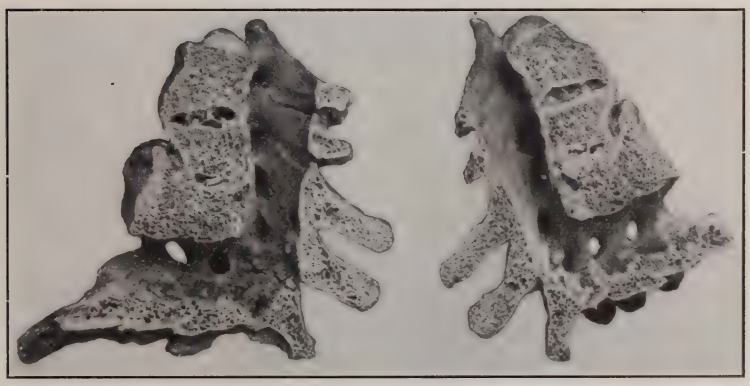
Wolff, speaking of the "scoliotic wedge," acknowledges that "pressure from the outside" deprives bone of space to grow in, and hence causes trabeculæ to be formed in abnormal positions and directions. Why should "pressure from the outside" pro-

duce such results and pressure from above not do the same thing?

Could we not consider the so-called "atrophy" on the concave side of the scoliotic wedge or the external condyle of genu valgum rather an osteosclerosis or condensation, and on the opposite side an osteoporosis, as better terms, whether due to superincumbent weight or "a functionally limited space to grow in," as Wolff puts it, or, better still, due to both?

In conclusion, I consider that all of us must concur fully with Wolff that pressure does not produce atrophy in bone, as Lorenz has claimed, under pathologically increased or trans-

FIG. 4.



Sections showing rectangular deformity of spine following Pott's disease, with no narrowing of the lumen of the spinal canal. No marked change is seen in the trabecular arrangement of the corticalis or spongiosa.

posed burdening; and also we must admit that functional transformation of bone must and does occur to meet the altered static demands of pressure, tension, and shearing strain.

On the other hand, I am not in a mental attitude—perhaps from incomplete study of this problem or from Wolff's arguments not being clearly logical to me—to admit that we can attribute all deformities to function alone, regardless of superincumbent weight.

That we can have, however, some deformities from functional demands and a functional transformation of bone I do admit, as is shown in the mal-union of a fractured humerus submitted

herewith (Fig. 1), in which, of course, superincumbent weight plays no part and function is the causative factor.

Fig. 5.

Sections showing deformity following mal-union of tibia and fibula. *c*. Functional bone transformation, as in Fig. 1.

On the other hand, the specimen of ankylosis of the hip-joint shows no additional lamellæ on the concave side of the femoral neck, as we would expect, nor condensation of the spongiosa. The trabecular arrangement is altered, however. (Fig. 2.) The specimen of ankylosis of Pott's disease shows but little increased

tissue density on the concavity of the curve. (Figs. 3 and 4.) Wolff's functional transformation is also shown in the specimen of mal-union of tibia and fibula (Fig. 5) and in that of the scoliotic vertebra. (Fig. 6.)

Finally, from a therapeutic standpoint, Wolff's law would seem to teach us the reason for the importance of *overcorrection* in genu varum and valgum, after operation, to promote bone transformation; also hyperextension in Pott's disease; a fixation

FIG. 6.

A scoliotic vertebra. *t*. Torsion of the lateral arches and spinous process is seen. *p*. Growth to the right of the vertebral body, with approximation of its superior and inferior planes on the right side ("scoliotic wedge"). *c*. Osteosclerosis of cortex, to meet the "functional demands" of "superincumbent weight."

position or exercises of *overcorrection* in scoliosis and its application to the correction of conditions like coxa vara, to strengthen weak points in the femoral neck by operation, assisted by functional conformation to meet static demands.

Finally, additional research along this line of thought by different observers would be most helpful to either establish finally Wolff's law or point out its limitations.

DISCUSSION.

Dr. Dane said that he had been deeply interested in the paper, the more so as the first accurate drawing of the internal structure of the human femur about which anything was known had been made by one of his relatives, Professor Jeffries Wyman, of Boston. It was through this plotting out of the femur that Wolff had been led to work out his law. Dr. Freiberg's paper had followed the general tendency of comparative study which had yielded so much in other departments of medicine. So far as he had learned from talking with Wolff, the latter had used exclusively thin plates of bone, whereas now many X-ray plates could be used for this study. Wolff had demonstrated, though perhaps not with mathematical certainty, that, in the general distribution of the trabeculæ each bone followed in the main the laws which mathematics approximated to and followed in the manufacture of artificial supports. Each bone structure was regulated by the work the bone was designed to do, and any change in functional stress was followed by a change in its structure. These facts should be borne in mind every time an apparatus is applied. We could then hope for rebuilding of the bone in knock-knee and allied deformities, and he hoped much more work would be done in this interesting field.

Dr. Weigel said that the question of weight-bearing as influencing the growth of bone he thought was pretty well settled, though its importance was not, perhaps, sufficiently appreciated. At the last Washington meeting he had shown radiographs of one case in which there was tuberculous disease of the knee, and in which, upon the living subject, it had been possible to demonstrate the actual change in the contour and structure of the bones of the foot as compared with the normal side. The shape of the

astragalus, the os calcis, and, in fact, all of the bones of the foot, was very different from the opposite side, which had constantly borne weight. If those changes go on to a considerable degree, it would naturally interfere with the normal functions. The point then was to determine how long the part could be kept immobile without interfering with the normal function and growth of the structures which are not directly involved.

Dr. Freiberg said with regard to Dr. Dane's remarks concerning the method of studying the internal architecture, that it was true that this study could be carried on by means of radiographs of the whole bone, but the necessary amount of detail could not be obtained except in the case of a few bones. For example, in the living os calcis the internal architecture could be determined with great sharpness. The illustrations shown here were made by taking radiographs of sections. This was a very convenient method, especially when there was considerable animal matter left. With regard to the question of pressure and superincumbent weight, he said that he had been interested in the remarks made by Dr. Taylor, but the point of it all seemed to be that in weight-bearing the bone was simply subjected to that amount of function. This superincumbent weight was modified to a greater or less extent by the condition of the soft parts surrounding the bone, so that this superincumbent weight might act in an abnormal way. Thus, a genu valgum or a flat-foot developed because the muscles were unequal to holding the parts in their normal relations. The weight was, in consequence, thrown in such a way that the interarticular structures themselves were interposed instead of being held in their proper relations by the muscles. The strains were borne by the articular structures, the bones and the ligaments, in an abnormal way, and in this manner function became abnormal; in other words, there was a physiological adaptation to that abnormal function. It made no difference whether one spoke of the condensation of bone seen in genu valgum and a condensation osteitis, or spoke of the atrophy on the other side as an osteoporosis, they both were nothing more than an accommodation to function.

THE RATIONAL OR COMBINED TREATMENT OF COXALGIA.

By R. TUNSTALL TAYLOR, M.D.,
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In Volume II. of our Transactions the question of what is the rational treatment of coxalgia was quite thoroughly gone into, and from the consensus of opinion then advanced, based on statistics not only of the extreme German ideas, which reached their maximum in 1879 in favor of radical excision, and then declined, and our own records of results as to life and usefulness of limb, both from mechanical and operative measures, one could but gather that the majority of cures resulted from the mechanical method. With the data then at hand one could not fail to be impressed by the thoroughness from every point of view with which the relative merits of excision, fixation, and traction were discussed in the scholarly papers there presented.

It will be recalled that this discussion followed the appearance of the "Three Lectures on Tubercular Joint Disease and Its Treatment by Operation," by Arthur E. J. Barker, in vol. i. of the *British Medical Journal* for 1888, which were in themselves masterly efforts. With the then newly discovered germ theory of joint tuberculosis as distinguished from scrofula, and new methods of asepsis, the author seemed to prove his case that excision was the better plan of treatment, except in those cases which were usually chosen for excision as a dernier ressort, namely, advanced disease with freely discharging and suppurating joints contending with a double infection. (One of his cases, however, that came in during the discussion of his paper showed far from a good result.) It is not to be wondered at that the mortality was so high in all statistics of excision col-

lected, as well as that secondary general tubercular infection as a result of this operation was common, when cases of this class were chosen whose vitality and resistive powers were at so low an ebb.

We were buoyed up by Dr. Phelps' presentation of Dr. Seneca B. Powell's discovery of the antidotal effect of alcohol on "pure carbolic acid," as applied by Phelps for disinfecting tuberculous joints, in his paper which was presented to us and published in 1900.[1]

The writer wishes he could bear unqualified testimony to this absolute antidotal effect of alcohol on pure carbolic acid, as applied to the hip-joint, but, as I will later regret to state, this is not always the case.

I will not review Volkmann's, König's, Hueter's, Senn's, Bloodgood's, and Willard's observations on the operative treatment of tuberculous joints, as they are familiar to all of you. Nor will I recite the few scattered cases reported in current journals, reviewed from the aspect of so-called "quick cures," with no regard to the ultimate history of the cases, as to death, relapse, or what we regard as of great importance, "joint function."

How these cases seek help for shortened, flexed, and adducted limbs by osteotomy from us, as specialists, we are all too familiar. One of these writers in regard to a hip case speaks of "seven years of conscientious orthopedic treatment," which he states consisted of iodoform injection and fixation in plaster-of-Paris, as applied by him yielding naturally no favorable results, as we would expect, and the patient having great pain, he decided to operate. He incidentally notes prior to his description of the operation that "the pain was greatly relieved by traction," evidently applied shortly before operation. He fails, however, to state his result of the operation as to joint function or the final outcome of the case. Incidentally, he apologizes for putting on a splint after the operation.

With these introductory remarks, before beginning with the subject in hand, I wish it understood that what I have to say

[1] New York Medical Journal, September 15, 1900.

is in the nature of a preliminary report, owing to its recent application and insufficient time having elapsed to draw definite conclusions as to its value so far as treatment is concerned. A further report I hope to make next year.

My paper is based on a point gained in the localization of tubercular foci by improved skiagraphic apparatus and the disinfection of tubercular bone cavities after operation by a new method. But for these two points and the results so far attained I would not presume to bring the old question of operative interference in tubercular joints before this Association. Further, in the discussion of this subject in 1889 by this Association, excision was the subject which was not considered the treatment of choice, although it was this that Barker favored before the Royal College of Surgeons of England, in 1888, and it is erasion which I now advocate.

I will not go into details in regard to previous methods of treatment and previous operative procedures in coxalgia, but will simply name the following:

A. *Mechanical Means.*

1. Recumbency and rest of the joint.
2. Recumbency, with traction in the plane of the bed.
3. Crutches and a high shoe on the foot of the well leg.
4. Thomas' fixation splint with or without thoracic band.
5. Plaster-of-Paris spica fixation from pelvis to knee or axilla to toes.
6. Recumbency with traction in the line of deformity.
7. Sayre's, Taylor's, and Phelps' traction splints with or without thoracic bands or lateral traction.
8. Lovett's and Dane's combined fixation and traction splints.

Of these eight, the third, sixth, and seventh have given us, by all odds thus far, the most satisfactory results when combined, and are by no means to be despised as to life, limb, and joint motion.

B. *Operative Means.*

1. Aspiration of the fluid in the joint.
2. Ignipuncture.
3. Trephining and drilling.

4. Aspiration of abscesses more or less remote from the joint.
5. Aspiration of abscesses and their injection with Brüns' iodoform emulsions in glycerin, olive oil, or ether; also of iodine, carbolic, and bichloride solutions.
6. Incision of abscess with immediate early or late closing of the wound.
7. Incision, erasion, and drainage.
8. Excision.
9. Amputation.
10. Brisement forcé.
11. Osteotomy to overcome faulty positions the result of disease and neglect.

After giving practically all of the above a thorough trial we have found them unsatisfactory, unnecessary, or useless, with the exception of incision when abscess is present, with early suturing to prevent secondary infection and osteotomy in neglected cases. It is, however, on the value of incision and erasion that the present preliminary paper is based from a new point of view.

Nearly all writers on the operative treatment have urged the removal of tissue well beyond the diseased area, or, in other words, the sacrifice of healthy useful tissues by excision. It has been stated repeatedly that the erasion of one focus would only be a part of what should be done, as it is impossible for an operator always to see all of the foci of disease, or, for that matter, in the hip of a small child to see any focus of disease in the hip-joint, without sacrificing muscular tissues by large incisions and much healthy bone. Others have claimed that the joint lesion is but a small part of the general tuberculized state of the individual. Further, it has been claimed a surgeon would infect fresh surfaces with disease at the time of the operation.

Again, in an early case with a caseating tubercle deep in a joint, the operator has been compelled to go at it blindly, or by aid of such procedures as the akido-peurastik of Middledorf, to detect the diseased softened focus, or from pathological knowledge that the initial focus of disease is in the femoral

head near the epiphyseal line usually, and if not there, then he is to look after removing the sound head or part of it, into the acetabulum for the focus, the synovial membrane being usually secondarily affected only after the process has burrowed from the bone into the joint.

Now what will the X-rays show us. Even from the onset of the disease we can detect that a pathological change is taking place in the favorite seats of bone tuberculosis by means of a clear good print, but still better in the negative. I have here a large number of prints which show clearly tuberculosis of the hip-joint in all of its various stages, and which, taken in conjunction with the symptoms present, should make the diagnosis extremely plain. Apropos of diagnosis by the skiagraph, we come to the comparative value of this method in diagnosis and the tuberculin method; it seems to me it is all in favor of the skiagraph as a certainty, if we can believe our eyes, against a very uncertain method obtained by reasoning and guesswork.

For, granted that we obtain a thoroughly reliable tuberculin, such as Trudeau's, and a positive reaction, can we be sure that no other part of the body, such as a bronchial lymph gland, has produced the reaction, and not the suspected joint. If, on the other hand, we obtain no reaction, as is more often the case, are we to keep on indefinitely for days inoculating the patient, thinking, possibly, something is wrong with the tuberculin, or that it has not been kept properly, or the dose was too small, etc., when an exact method is at hand which will show us within the hour, including the taking of the radiograph and developing the plate, the characteristic lesions, if present. Williams, in his valuable work, *The Roentgen Rays in Medicine and Surgery*, says in regard to the tuberculin test: "If we use the tuberculin test as a guide where the general symptoms suggest tuberculosis, we shall employ it in cases where tuberculosis does exist; but if in an early stage it may be overlooked unless more than one dose is given. For example, in the early stages patients do not react to one milligramme of tuberculin, sometimes not to five, or perhaps not even to larger amounts. We are obliged, then, in using tuberculin, to give

it to many patients who prove not to have tuberculosis, and to give it to them a number of times to prove or disprove the tentative diagnosis, because we are not justified in inferring that tuberculosis is absent when there is no reaction to a small dose. Likewise, if a second or third injection is required, there should be an interval of several days between the injections, and, therefore, time is consumed.

"Great care is required to carry out the tuberculin test and experience to interpret its results, for it may not be easy to decide whether the effects produced should or should not be interpreted as a reaction. Further, some physicians are unwilling to use this test, partly because no reaction may follow until several injections have been made, and partly because other diseases react to tuberculin. Likewise, there are many patients who will not permit its use.

"Again, even if the patient reacts to tuberculin, the test does not locate the lesion nor give its extent. It may be a pulmonary tuberculosis or a tuberculosis of some other part of the body; the test does not show whether or not the lungs are involved. The seat of the disease is, of course, of importance in treatment —a patient with tuberculosis of the foot need not be sent to Colorado."

With good negatives, and in conjunction with the symptoms and history, mistakes in the diagnosis of tubercular hip disease for coxa vara, congenital hip dislocation, infantile paralysis, arthritis deformans, etc., are now practically impossible. Only in the very earliest stages where the skiagraph has failed to show any joint lesion should one now be tempted to use tuberculin.

What do the negatives show? I use the word negative because it is with them we are concerned, before positives can be made, in our anxiety to make a diagnosis.

First, in the earliest stage, we find usually a slight clouding of the joint, and at the epiphyseal line of the head of the femur a spot whiter than the surrounding black bone (Figs. 1 and 2) a little later this will show a heterogeneous mixture of light and dark areas in the epiphysis of the femoral head, suggesting a disorganization or osteoporosis. (Fig. 3, Case II.)

The next type we have is that seen when the disease has progressed a little further and a marked clouding of the whole

FIG. 1.

x

Beginning focus in epiphyseal line. Very early stage. The x indicates diseased side. The use of a magnifying glass will bring out much more detail. (Case of Helen M.)

joint area occurs, which is most characteristic, as though we saw the joint structures through a haze, then gradually, first

FIG. 2.

x

Disease in the epiphysis of the femoral head.
(Case of Esther V.)

the epiphysis of the great trochanter is lost to view, and then that of the head is blurred out, and the whole joint looks much

whiter and paler than its mate. At times, as the disease advances, we note punched-out areas of the head or neck or acetabulum that have undergone caseation, liquefaction, absorption, or still remain as so-called tubercular pus in the capsule. (Figs. 4 and 5.) Still later we see efforts at repair with new-

FIG. 3.

x

Beginning left tubercular osteitis of the hip-joint, foci in the femoral head and neck. Heterogeneous mixture of light and dark areas. Abduction of thigh shown by tilted pelvis. Obliteration of trochanter major's epiphysis and general clouding of the whole area of hyperæmia.

Amount of motion in flexion, forty degrees; abduction, ten degrees; adduction, five degrees. Night-cries and muscular spasm present. (Case II. of series, Mary D., before operation.)

growth of bone and exostosis, or condensation, and consolidation, and ankylosis. (Fig. 6.)

The clouding seen in the early and acute stages gradually disappears as healing begins. It occurred to me that possibly the hyperæmia and leucocytes hurrying to and from the scene

of the conflict took up the lime salts in the diseased area and caused this appearance. It further shows us that the inflammatory area is by no means limited to the bone that could be removed, even by an excision of the head, neck, and trochanter of the femur, and the acetabulum as well. So surgery cannot be expected to do all the curing, nature must do part any way.

With the situation of the focus or foci of disease staring us in the face, as it were, are we not in a better position now than ever before to cut down and remove the cause so far as possible,

FIG. 4. FIG. 5.

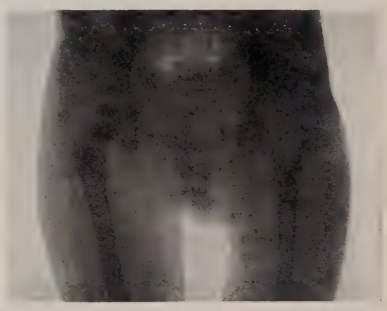

FIG. 4.—Case IV., Ida W., before operation. Caseation of right femoral head, neck, and epiphyses. Very acute joint; no motion; marked muscular spasm and night-cries present. Real length, both legs, 17½ inches; apparent length: right 19¼, left 19½ inches.

FIG. 5.—Case IV., Ida W., after operation, showing area from which all necrosed bone was removed. Right leg, 18¾ inches; left, 18½ inches. From umbilicus: right 21½, left 21 inches. Motions: flexion, forty degrees; abduction, ten degrees; adduction, five degrees; rotation out, eighty degrees; rotation in, ten degrees.

using the skiagraph as a guide to locate our incision, and sacrificing as little of bony tissues and soft parts as possible?

What are the objections to operation. The objections to excision were, first, the danger of wound infection; second, the dissemination of the tubercle; and, third, a shortened limb and insecure joint, if not an ankylosed one.

I think, as applied to erasion with our present surgical technique, with the use of rubber gloves, veils, and the other refine-

ments of modern methods, we can disregard the first objection with its attendant dangers as being a thing of the past, for now we have primary union. Second, the dissemination of the tubercle, in suitable cases, that is, in those whose vitality is not in a wretched state from prolonged disease and suppuration, is, as Phelps puts it, more of a "bugbear" than a reality, especially if we are cautious in choosing the least bloody route to the focus, in keeping our wound as dry as possible, and clamping or occluding all bleeding points immediately by thorough flushing with hot salt or bichloride solution, and the wiping out of the diseased débris with sterile gauze. I have yet to see a case in which I could attribute general miliary tuberculosis, tubercular

FIG. 6.

x

Efforts at repair with new-growth of bone around femoral head and neck and acetabulum. Ankylosis. Legs parallel. (Case of Daniel J.)

meningitis, or other metastasis to the operation; in fact, I have had no such mishaps, except from brisement forcé, which we can well understand would tear open a healed tubercular focus and rekindle the process without the removal of the cause.

The third objection, a shortened limb, etc., need not hold in an erasion, as it does in excision, for in the former, after locating the focus by means of the X-rays, we need only remove it with the curette, and possibly the chisel, without taking the epiphyses of the head and trochanter major away, as was frequently done in excision. Stimulation of the epiphysis may even result.

Even granting that our skiagraph shows us that the whole femoral head has undergone caseation and disintegration, or that separation has occurred in the neck (a pathological excision or epiphyseal separation), would anyone expect the normal rate of growth and perfect function to be obtained by leaving it in the capsule? Such removal and disinfection of the joint could but hasten healing. Which of us with a neglected and advanced condition such as just described would not prefer an ankylosed hip-joint at once to one that would have a number of discharging sinuses for years, with ultimately ankylosis?

Now what are the advantages to be gained by erasion and disinfection? First, the removal of the cause of the local disease; second, the shortening of the duration of the disease; third, the arrest of the spread of the disease. Not to use Phelps' expression of a joint "macerating in pus," I think we may consider from clinical experience the possibility of partial or total joint destruction ensuing, with partial or total abolition of joint motion and shortening, if the disease is not checked at the onset. The advantages named are simply ideal, but even granting that, should they not be our chief aims in treatment?

So far as I know there are no available statistics of erasion simply in tubercular joints, and to form an opinion of its value we could not apply those from excisions as tabulated:[1]

I hold that erasion, with modern surgical technique back of us, must give a lowered mortality both from wound infection or metastasis, and, by the removal of all or a large part of the disease, the duration must be lessened and the extent of the disease minimized.

[1] Rinne: Deutsche medicinische Wochenschrift, 1884, No. 20. Caumont: Deutsch. Zeits. f. Chir., 1884, vol. xx. p. 344. Volkmann: Verhdl. d. Deutsch. Ges. f. Chir., 1877, 59. Korff: Deutsch. Zeits. f. Chir., vol. xxii. p. 149. König: Archiv. f. Klin. Chir., vol. xxvi. p. 822. Wright: Chirurgical Society Transactions, vol. xiv. Marsh: British Medical Journal, August 3, 1889. Elben: Centralbl. f. Chir., 1879, No. 2. Holmes: Medical Times and Gazette, November 3, 1877. Croft, for committee of Clinical Society: Clinical Society Transactions, vols. xiii. and xiv. p. 234. Grosch: Centralbl. f. Chir., 1882, No. 14, p. 229. Sayre: Orthopedic Surgery, second edition. Of these, Grosch's seem the fairest statistics, because he divides his cases into beginning, severe, and hectic cases.

Preparation for the Operation. The majority of patients are admitted with a position of flexion or malposition, and are put to bed with traction in the line of deformity. This is maintained until the parallelism of the legs is restored and the acute symptoms have subsided. It is then possible to obtain a good skiagraph, which was, of course, not the case when the leg was flexed.

The Operation. 1. *Choice of Cases.* With our skiagraphs, position and motion records before us, we can distinguish the exact condition of the joint and determine on the method of procedure, as follows: in beginning cases, where the focus is very small indeed, well within the bone, and not encroaching on the joint surfaces, we can at least leave these to conservative methods of *rest, fixation,* and *traction* in the hope that nature, assisted by good hygiene and tonics, will arrest the disease and furnish a strong fibrous wall to resist further inroads of the process, as we all know *it is possible to obtain a cure* in early cases. Such cases should have X-ray examinations made from time to time *to be sure* that there is no extension close to the bone periphery or actual joint invasion; if extension is found then operation must be done without delay.

If the case has *extensive sinuses* which are secondarily infected, the patient's condition is bad, and the skiagraph shows extensive joint destruction, nothing can be gained by erasion (nor by excision, as Barker pointed out), and our best plan is to lay the sinuses wide open and overcome the secondary infection as soon as possible, leaving the original trouble to conservative methods. Experience has taught us the practical impossibility of helping these cases by extensive operation from the prolonged suppuration that usually follows with hectic fever and amyloid changes.

Thus it will be seen that I urge from my experience the operation of erasion on what we might call cases of moderate bone involvement or the middle class of cases.

2. The Choice of Incision. Of course, the incision for an erasion differs from that needed for an excision; but that first used in 1878 by C. Hueter for excision, and bearing his name,

and a little later used by R. W. Parker independently,[1] known as the "anterior incision," I have found the most useful. I have also used White's or Langenbeck's lateral incision, but have had no experience with Cheever's, Ollier's, or Sayre's. In one case, where the abscess was evidently on the posterior aspect of the joint, I have used Heyfelder's posterior incision.[2]

The anterior incision, which as I have said I prefer, I make in the following way: beginning at the anterior superior spine, I make an incision for four or five inches through the skin; then through the fascia lata one can see the intermuscular space between the sartorius and rectus on the medial side, and the tensor vaginæ femoris and gluteus medius on the lateral side, and this space is laid open. This brings one down to the capsule, which can be opened vertically in the line of the incision, or at an oblique angle upward and inward, injuring the Y-ligament as little as possible in laying bare the femoral neck and head. The anterior incision brings one closer to the head and neck, owing to their direction being forward as well as inward and upward. With the X-ray negative in a window of the operating-room the surgeon can locate the focus of disease and then look in the wound (or in very small children feel for it). When found one usually has to begin with a small curette, and then gradually employ larger and larger ones, as may be necessary. The strong, round, irrigating curette, described by Willard,[3] I have found most useful.

Disinfection of Joint. When all diseased tissue has been removed, the capsule thoroughly curetted, if necessary, and healthy bone for about 1 mm. all around the focus of disease cut away, the joint is thoroughly flushed with hot normal salt solution or sterile water, and, in the case of much bleeding, hot 1 : 1000 bichloride for its astringent effect, to occlude the absorptive vessels, as well as its antiseptic value.

The joint is then dried with sterile gauze, and in my earlier

[1] British Medical Journal, 1888, vol. i. p. 1325.

[2] Bradford and Lovett, Orthopedic Surgery, 1890, 1st edition, pp. 339–341.

[3] Transactions of the American Orthopedic Association, 1889, vol. ii. p. 145.

cases I used Phelps' suggestion for "pure carbolic acid," and filled the joint with it for one or two minutes, to kill any remaining bacilli, and followed it with alcohol. This method of disinfection I have abandoned, however, as I had a child practically die instantly on the table before my eyes from carbolic acid poisoning, notwithstanding the immediate free local use of alcohol and other methods of general stimulation; it was possibly from some large absorptive vessel taking it up as soon as put in the cavity. The symptoms were not those of fat embolism and were synchronous with the application of the carbolic acid.

I now use for this purpose a 2.5 per cent. solution of formalin, obtained from the commercial 40 per cent. stock solution. This strong antiseptic has, as is well known, caustic, deep penetrating powers, and is left in the joint for five minutes, when the latter is again thoroughly dried. A small wick of iodoform gauze is placed in the wound, reaching to the bottom of the cavity. No sutures are taken in the capsule, but the fascia lata is sewed up tight by a continuous subcutaneous suture of silver wire. These sutures pass around the wick of iodoform, which is perhaps unnecessary, except to allow the escape of serum and hemorrhage, which are never abundant. The wound is then covered with silver foil and ample gauze dressing. The child is put on a Bradford frame, and five or more pounds traction is used. On the seventh day the iodoform wick is withdrawn, and on the tenth day the silver sutures are withdrawn, and the wound is found dry and healed per primam.

I consider the fixation on the Bradford frame and a small amount of traction as important in giving thorough rest and fixation to the part, protecting it from traumatic motions and positions. Thus we can expect the healing process, after the disinfection of the joint, to take care of and destroy any remaining bacteria, assisted by the circulatory changes due to the operation.

This recumbency and traction should be maintained for eight or more weeks, to allow ample time for repair, and then the patient is allowed to get up with a long traction splint, high shoe, and crutches, just as though we were treating an early

case of coxalgia. At the end of six months or a year or more, if all symptoms have subsided, the brace, crutches, and high shoe can be cautiously discarded.

It is this after-treatment following the operation that I have meant in the title of my paper the "combined treatment" of coxalgia.

The cases I have selected to report are from the various types one encounters, and while the operations have been so recent, still, from the rapid improvement in the joint conditions, as compared with similar cases treated conservatively, I feel justified in reporting the following as a result of the operation. Further, the skiagraphs after operation show a general clearing up of the joint cloudiness.

Case I.—Hospital No. 410, M. E. W., girl, aged eight years, admitted to my wards in the Hospital for Crippled Children, October 10, 1901. Family, personal, and traumatic history negative. The trouble in her right hip, of six months' duration, came on gradually with limp, followed by pain, which was worse in the morning. Night-cries were present, and she persisted in supporting her thigh with both hands until traction was applied. There was marked muscular spasm around the hip- and knee-joints, but the trochanter was not above Nélaton's line. The thigh was held in a "position of flexion" of fifty degrees, and a position of adduction of ten degrees. Circumference of right thigh, 23 inches; left thigh, 23½ inches; right calf, 6 inches; left calf, 7 inches. No motion in any direction was possible.

After the parallelism of the legs was restored by traction, erasion of the upper and anterior portion of the femoral head and neck was done on February 26, 1902, and "pure carbolic acid," ℥ij, was put in the capsule, followed by alcohol, as described. Nothing of note occurred after the operation, except that hemorrhage was rather more profuse than usual. Healing was primary, however. Condition of patient April 21, 1902: length of legs to internal malleoli from anterior superior spines, 23¾ inches; from umbilicus: right 26½ inches, left 26 inches; position of flexion, 0 degrees; abduction, five degrees. Motions: flexion, ninety degrees; abduction, forty-five degrees;

adduction, thirty degrees; rotation out, ninety degrees; rotation in, forty-five degrees. (Figs. 7 and 8.)

Very slight muscular spasm at limits of motion. X-ray after operation shows clearly the general clearing up of the joint

FIG. 7. FIG. 8.

x x

FIG. 7.—Tuberculous disease of the upper anterior portion of the right femoral head and neck. Joint extremely acute and painful. No motion in any direction. Legs equal in length (23¾ inches). Right apparently one-half inch longer. (Case I., Mary W., before operation.)

FIG. 8.—Same as Fig. 7, after operation, showing general clearing up of whole joint area and distinct light area, where the tuberculous débris was removed. Legs equal in length. Motions: flexion, ninety degrees; abduction, forty-five degrees; adduction, thirty degrees; rotation out, ninety degrees; rotation in, forty-five degrees. (Case I., Mary W., after operation.)

and the foci removed at anterior and external aspect of head, neck, and trochanter; also upper lip of acetabulum.

CASE II.—M. D., girl (history No. 388), aged four and one-third years, came to the dispensary May 17, 1901. Family

and personal history negative. Trouble in left hip of two weeks' duration and sudden invasion. Fell on street, striking her hip and knee. Pain and lameness were noticed immediately; pain worse at night. Had night-cries; measurements showed length from anterior superior spines, right 18¼ inches, left 18 inches; length from umbilicus: right 20½ inches, left 20½ inches; position of flexion, ten degrees; circumference of thighs: right 11½ inches, left 11 inches. No motion in any direction. Rest ordered. Mother to bring her back for observation. July 11, 1900, condition unimproved, admitted to the hospital and kept on Bradford frame with traction for one month, during which her motions became much improved, and was discharged at the request of her mother. On readmission, September 24th, examination showed length from anterior superior spine: right 19⅜ inches, left 19⅜; length from umbilicus: right 22½ inches, left 22⅛ inches. No position of flexion. Motion in flexion, forty degrees; motion in abduction, ten degrees; motion in adduction, five degrees. Marked muscular spasm. March 24, 1902, her motions not being improved, and her intrapelvic glands being much indurated, an operation was decided upon after the X-ray showed a focus of disease involving the epiphysis capitis. She was etherized, the left hip-joint was opened, and the diseased area was removed. When pure carbolic acid was put into the joint the anæsthetizer noticed immediately sudden dilatation of the pupils, which soon contracted. The joint was immediately washed out with 95 per cent. alcohol; respiration then became of a rapid, heaving, and sighing character, which would almost cease for some seconds, the efforts then being very feeble. Bloody fluid and froth ran from her mouth, evidently from the congested lungs. The pulse ran from 140 to 160, and then became uncountable.

Inversion, artificial respiration, infusions, and stimulations of various kinds were resorted to without avail. Patient died on the table in about twenty minutes from the time the acid was used, with the pupils widely dilated, and temperature fell to 97° F. just before death. Patient had run a temperature of about 100° F. prior to the operation. (Fig. 3.)

Case III.—History No. 418, L. R., girl, aged seven years. Admitted October 28, 1901, for right hip disease. Family history negative. Patient has had measles, scarlet fever, whooping-cough and chickenpox, the last just before present trouble began, two years ago. No traumatic history. Trouble began with limp; had pain on admission, which is worse at night, and

Fig. 9.

x

Shows tuberculous foci removed from neck and at epiphyseal junction of right hip. Result, legs equal. Motions: flexion, sixty degrees; abduction, thirty degrees; adduction, forty-five degrees; rotation out, forty-five degrees; rotation in, twenty degrees. (Case III., Libby R., after operation.)

night-cries are present. Length from anterior superior spines: right $22\frac{3}{8}$ inches, left $22\frac{1}{4}$ inches; length from umbilicus: right $22\frac{3}{4}$ inches, left $24\frac{1}{2}$ inches; position of flexion, fifteen degrees; position of abduction, five degrees; circumference of thigh: right $14\frac{3}{4}$ inches, left $15\frac{1}{4}$ inches; circumference of calf, right $8\frac{1}{2}$ inches, left 9 inches. Left leg held fixed by muscular spasm, so that *no motion is possible.* Operation February 19th; X-rays show

extent of disease before operation and amount of tissue removed. Anterior incision and pure carbolic used. April 21, 1902, motions: flexion, sixty degrees; abduction, thirty degrees; adduction, forty-five degrees; rotation out, forty-five degrees; rotation in, twenty degrees. Muscular spasm hardly appreciable, and legs both apparently and really equal in length. (Fig. 9.)

Case IV.—Hospital No. 392, I. W., girl, aged four years. This case was admitted July 28, 1901, suffering with right coxalgia of three months' duration, and, although operated on May 7, 1902, I report it as one of those cases which in all probability would have resulted in ankylosis whether operated on or not. I determined on an operation to save the child from the strain of prolonged discharging sinuses. The skiagraph, taken before operation, shows how extensive the disease was, involving the entire head and neck well down toward the trochanter. The child had no vitality and had had whooping-cough during the winter, which rendered her hip more acute.

On admission she had a most acute joint, and was one of those frail-looking children with no powers of resistance. Family, personal, and traumatic history was negative. Position of flexion, thirty degrees; position of adduction, ten degrees; right and left legs equal in real length ($17\frac{1}{4}$ inches); apparent, right $19\frac{1}{4}$ inches, left $19\frac{1}{2}$ inches. No motion was possible.

At the operation nothing but gritty remains of the right femoral head was found, and the cartilaginous portion of the head was loose in the capsule as a shred, perhaps one and one-half inches long and half an inch wide. Formalin was used to disinfect the joint. The wound healed per primam.

Status Præsens. Motions: flexion, forty degrees; abduction, ten degrees; adduction, five degrees; rotation out, eighty degrees; rotation in, ten degrees. Right leg, $18\frac{3}{4}$ inches; left, $18\frac{1}{2}$ inches; from umbilicus: right $21\frac{1}{2}$ inches, left 21 inches; right thigh 9 inches, left $9\frac{1}{2}$ inches; right calf $6\frac{1}{2}$ inches, left $6\frac{1}{2}$ inches. Muscular spasm is present, but whether voluntary or involuntary, one cannot tell. The present indications are that the child will not have a stiff joint; but how much motion she will ultimately have, or whether there will be a relapse, it is impossible to say;

there is, however, no indication at present of a relapse, and the child's general condition has improved. How stable her joint will be is also problematical. (Figs. 4 and 5.)

Case V.—History No. 333, R. W. L., boy, aged four years. Maternal grandmother and paternal aunt died of phthisis. Was bottle-fed. Has had pertussis. Fell down a short flight of steps in 1898. Came to Hospital for Crippled Children, April 24, 1899, suffering with hip disease on the left side. First symptom noted was pain in knee, followed by lameness. Right thigh, $11\frac{7}{8}$ inches; left thigh, $11\frac{1}{2}$ inches; right calf, $8\frac{1}{2}$ inches; left calf, $8\frac{1}{4}$ inches; right leg, $17\frac{3}{8}$ inches; left leg, $17\frac{3}{8}$ inches. Motions: in flexion, sixty degrees; extension, 0 degrees; abduction, twenty degrees; adduction, ten degrees; rotation in, thirty degrees; rotation out, forty-five degrees; position of flexion, fifteen degrees. After usual bed and splint traction treatment with ups and downs in condition, on February 27, 1902, was readmitted to the hospital, as general and joint condition were not good, having no position of flexion, but evident thickening around joint, the remains of abscess of six months previous. Measurement showed length from anterior superior spine, right, $21\frac{1}{2}$ inches; left, $21\frac{1}{2}$ inches; from umbilicus, right, $23\frac{3}{4}$ inches; left, $23\frac{1}{4}$ inches; motion in flexion, thirty degrees; abduction, ten degrees; adduction, five degrees; rotation out, ninety degrees; rotation in, five degrees. Had marked muscular spasm and thickening around left trochanter. The skiagraph showed extensive destruction, with involvement of the femoral head and joint. An operation was decided on to check the disease, which seemed to be progressing, and on March 27, 1902, the diseased area was removed and one ounce of liquid pus was found in the joint; pure carbolic acid and alcohol were used. Joint healed per primam with these resulting motions: flexion, thirty degrees; abduction, fifteen degrees; adduction, fifteen degrees; rotation out, thirty degrees; rotation in, thirty degrees. Muscular spasm is still present. The legs are equal in length. This case is also one of those that would have had sinuses in all probability, and is the only one in which I have found liquid pus in the capsule. (Fig. 10.)

Case VI.—History No. 302, T. C., boy, aged eight years, admitted to hospital August 21, 1900, with right hip disease. Mother died of phthisis. Patient had been under treatment for two years, with fixation, before coming to us, was thin, anæmic,

Fig. 10.

x

Invasion of joint by tuberculous process, as shown after the diseased area has been removed. Both the epiphyses of the femoral head on the left side, the synovial membrane, and the acetabulum were involved. The operation should have been done when the disease was confined to the femur. The legs are equal in length, and about one-third of the normal range of motion is the result of the operation; but even this amount of motion seems to be lessening from adhesions within the joint. The clear area near the upper left-hand corner is flatus in the intestines. Atrophy of the femoral shaft is shown. (Case V., R. W. L., after operation.)

and had no motion in joint, and two discharging sinuses. In September, 1900, had typhoid fever. There was no position of flexion. Leg measurements: from anterior superior spine: right 24½ inches, left 24½ inches; from umbilicus: right, 27

inches, left 26⅜ inches; circumference of right thigh, 10 inches (abscess); circumference of left thigh, 8⅛ inches; circumference of right calf, 6½ inches; circumference of left calf, 6¾ inches. After nearly two years of traction treatment this boy's case was unchanged and he had periodic attacks of pain and hectic fever at times, from infection of sinuses. The radiograph of this case was made, and showed extensive joint disease involving the femoral head and acetabulum. Marked circumferential atrophy in the femur was also noted. Operation of erasion was done March 5, 1902, with carbolic acid disinfection, after the sinuses had been dissected up as far as possible and a large quantity of granular bone removed from the head and acetabulum; capsule was thoroughly curetted. Anterior incision used. No gain in motion was to be expected in this case, which had undergone practical ankylosis, and even the discharge seems to be about the same from the sinuses. This case with Case VIII., which follows, seems to me to point out the fact that diseased joints with sinuses of long duration should not be included in those where good functional use was to be hoped for, nor where primary union should be sought.

Case VII.—History No. 240, F. H., boy, aged five years. Maternal and paternal uncles died of consumption. Personal and traumatic history negative. Trouble in left hip, duration one year, peculiar gait noted when two and one-half years old. No night-cries present. Traumatic history negative, general condition poor. Was admitted to hospital January 31, 1900, recumbency on Bradford frame and traction used, and in August of same year had an abscess to appear which was aspirated. Joint became much worse with further abscess formation, with destruction of a great deal of tissue. Position of outward rotation, ninety degrees; motions, flexion, thirty degrees; abduction, ten degrees; rotation in, five degrees.

In November, 1900, a radical operation of erasion was performed by posterior incision (Heyfelder's). Bichloride solution, 1:2000, was used, the wound was packed, and healed by granulation, and he improved rapidly both constitutionally and in movements of the joint.

Examination, June 4, 1902: length from anterior superior spine: right 22 inches, left 21½ inches; length from umbilicus: right 24½ inches, left 24½ inches; position in abduction, five degrees. No position of flexion; motion in flexion, forty degrees; abduction, thirty degrees; adduction, ten degrees; rotation out, ninety degrees; rotation in, 0 degrees. General condition very good. (Fig. 11.)

FIG. 11.

x

Result after extensive disease followed by erasion through the posterior incision. Real shortening one-half inch; apparently no shortening. About one-third of the normal range of motion. (Case VII., Frank H., after operation.)

CASE VIII.—February 20, 1901, J. S., boy, aged five years, came to the dispensary of the Hospital for Crippled Children. Family and traumatic history negative. Had pertussis. Location of trouble was in left hip of nine months' duration, of gradual invasion. Pain and limping were first symptoms, night-cries were present, loss of flesh was marked.

Was treated at another hospital for five months before he came to the Hospital for Crippled Children. Hip was extremely acute, with much thickening around great trochanter. Inguinal glands enlarged. Muscular spasm marked. Length from anterior superior spine: right 16¾ inches, left 16½ inches; length from umbilicus: right 19¾ inches, left 19 inches; position of flexion, sixty degrees; circumference of thigh: right 9¼ inches, left 8½ inches.

No motion in any direction. All forms of bed treatment, including fixation in plaster from knee to axilla, *with traction;* fixation from toes to axilla, inclined plane much elevated, to relax psoas spasm, with traction, etc., were resorted to, but still he had night-cries and great pain. The thigh was undermined with burrowing pockets of pus, and sinuses had broken on the external aspect below the joint in the groin. Skiagraph showed extensive disease. The boy was operated on December 27, 1901, by external incision, and erasion of joint done, but not satisfactory with this incision. All sinuses were freely opened and granulation tissue cut away, wounds packed with gauze, after thorough washing with 1 : 2000 bichloride and normal salt solution. Where tissues looked healthier, subcutaneous suture was used to close skin wounds. The boy's leg was literally cut wide open by the various incisions, both vertical and transverse. January 27, 1902, hip still very acute; but motions of five degrees possible in every direction without muscle spasm. General condition much improved, and no return of pain. Some discharge still from sinuses. Child sent to country with the aim of out-of-door life, with recumbency and traction. This is one of those cases which has passed the time when joint function might have been preserved by an earlier operation.

Case IX.—W. E., boy, aged four years, admitted July 12, 1899, with right hip disease of eighteen months' duration and position of flexion of sixty degrees; no motion. Legs equal in real length (18¼ inches). From umbilicus: right 21 inches, left 21½ inches.

The child improved with bed treatment and with long traction splint until he had a fall, in August, 1900, when he was

readmitted in a miserable condition. In June, 1901, had another fall in the wards, joint became very acute, temperature rose, and abscess with sinus formed. Child was kept recumbent, with traction, until February 5, 1902, when erasion was done, as in Case VIII., by external incision, for the child's condition was not improving. The X-ray showed separation of a portion of the acetabulum and a punched-out erosion in the upper surface of the femoral head. Carbolic acid used after bone débris and sequestra were removed.

FIG. 12.

Separation of a portion of the acetabulum and a punched-out erosion of the femoral head with epiphyseal separation and its dislocation. Abduction of thigh and downward tilted pelvis. (Case IX., Willie E., before operation.)

May 12, 1902, some muscle spasm, but general condition excellent. Leg shows a quarter of an inch real shortening and abduction of ten degrees. Motions: flexion, thirty degrees; abduction, twenty degrees; adduction, twenty degrees; rotation out, thirty degrees; rotation in, thirty degrees. Allowed to be up and about wearing a brace. Slight discharge from sinus, about ten drops a day. Sent to the country. (Fig. 12.)

I will not trespass further in reporting similar cases, but give the above simply to indicate the types of the three varieties which a surgeon is called on to treat, and wish to emphasize that type in which we operate with most satisfactory results before exten-

sive joint destruction has taken place and sinuses have formed, aided in our knowledge of the condition by the X-ray.

I cannot close this paper without expressing the deep gratitude we feel to Dr. L. A. Weigel, of Rochester, for his helpful teaching and guidance in our X-ray work.

ON THE REMITTENT LIMP IN THE FIRST APPARENT STAGE OF HIP-JOINT DISEASE.

WITH REMARKS ON THE EARLY DIAGNOSIS OF THIS DISEASE.

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NEW YORK CITY.

On the 12th of November, 1901, I saw in consultation with Dr. J. F. Lyon, a boy, J. V., aged six years, who presented the following history:

Early in April, 1901, the patient, after a slight accident, commenced to limp. The limp was quite pronounced, but was unaccompanied by any pain. The patient was a very active little fellow—a sort of leader among the children of his neighborhood, a quick runner, and a good jumper. His parents thought at first that the limp was occasioned by the slight sprain referred to. But little attention was paid to the matter for the first few days; but as the limp persisted and was worse after rest, and especially so after getting out of bed in the morning, it was thought that the condition might be due to rheumatism, and this view was emphasized by the fact that the limp was favorably modified by exercise. The boy essentially, and I think, instinctively, modified his activity during this time, and voluntarily gave up his most active out-door exercises. After the first ten days the limp steadily improved, and finally disappeared in about two weeks. He then gradually resumed his wonted excessive activity and again became the leader of the street in "stunts" of various sorts. The parents and neighbors assert positively that the limp entirely disappeared and that the boy became as agile and as active as before the attack. No treatment whatever was given.

Nothing unusual presented in the history of the boy until

the August following, when he again commenced to limp. On this occasion there was no apparent cause—that is, the limp could not be traced to any distinct sprain or wrench. It was supposed to be rheumatism by the parents who, as on the previous occasion, did not seek professional advice. The child had no treatment whatever. The limp was pronounced, more so than in the previous attack, and presented, generally speaking, the characteristics mentioned above. It was also a little more persistent, and nearly a month went by before recovery occurred. The incident did not attract special attention. The boy had simply, in the parents' minds, recovered from a slight attack of rheumatism. So far as the parents could see, recovery was complete, and the boy went on the street again to his usual sports and games.

About a month before I saw the patient he had had a third attack of limping, which was again disregarded by the parents. The matter attracted only casual notice, as he had already recovered from two previous attacks without any professional advice. On this occasion, however, the symptoms were more persistent; the limp became gradually worse, instead of gradually better. After a while the patient could scarcely walk, and yet he had no pain. Locomotion became very awkward, then difficult, and finally an explosion of acute symptoms occurred. When I saw him he was in extreme pain, the thigh was flexed badly, abducted and rotated outward, and any movement of the bed even was followed by excruciating pain. In short, the patient was suffering from hip-joint disease in its most acute stage.

I venture to cite this interesting history because it is typical of quite a large number of cases which have come under my observation, and because I think that this early remittent limp is not, as yet, sufficiently recognized, nor is its importance fully appreciated by the medical profession, although Barwell, in his classical work,[1] says: "The limp, therefore, may be absent a week or so, and then return, perhaps to remain permanent, perhaps again to intermit."

[1] A Treatise on Diseases of the Joints. By Richard Barwell, F.R.C.S., second edition. McMillan & Co., London, 1881, p. 437.

On the occasion of the third annual session of this Association, held in Boston in September, 1889, I read a paper "On the Principles of the Mechanical Treatment of Hip-joint Disease,"[1] in which I say: "It is well known that in this first stage of hip-joint disease — the stage of vulnerability . . . —the limp referred to as occurring in the first stage may disappear. . . . I have known this to occur seven times in one patient before the symptoms became so pronounced that a diagnosis was made, the surgeon in attendance being unfamiliar with the fact that a remission of the limp was likely to occur in the early stage."

It would seem that I was mistaken in saying that the remittent limp was "well known." One of my hearers—a prominent member of the Association—in the discussion which followed said: "The statement has been made to-day that in certain cases the limp disappeared. . . . I confess I have never seen a patient who once began limping with hip disease lose the limp until the case had been some time cured."[2]

The only other reference to the matter at the Boston meeting in the prolonged and interesting discussion which followed a "Symposium on Hip-joint Disease" (my paper being one) was made by Dr. Herbert L. Burrell, of Boston, who said: "There is one point I would like to refer to, and that is with reference to the subsidence of the limp during the course of the disease. . . . I feel quite sure I have seen this in certain cases, not, however, without treatment. We have cases that come to the Children's Hospital, where it is difficult to make a diagnosis. The child perhaps has a slight limp; we send it home and request that it be kept in bed a week. The mother returns with the child, there is no limp, and the limb remains this way for possibly a month or two, when the child returns with a recurrence of the limp."[3]

I was led to say in my paper that the remittent limp was well known because Barwell and others had described it, and

[1] Transactions of the American Orthopedic Association, 1889, vol. ii. Also New York Medical Journal, November 23, 1889.

[2] Transactions of the American Orthopedic Association, vol ii., 1889, p. 161.

[3] Op. cit., p. 193.

I had taught that it was a frequent factor in the histories of many patients coming under my observation, and I have been in the habit of emphasizing the value, as well as the danger, of this significant manifestation of the first apparent stage of hip-joint disease, both in my lectures at the New York Orthopedic Dispensary and Hospital (1876–1898) and at my lectures at the University Medical College (1882–1886). These facts are my excuse for bringing the matter thus prominently to your attention.

More recently, however, the matter has received attention. Bradford and Lovett, under a special caption, "Remissions," in their chapter on Hip Disease, say: "Any account of the symptoms of hip disease would be incomplete without speaking of the remissions in the course of the affection. In the early stage this is especially noticeable, and a patient may, to outside appearances, entirely recover from the symptoms of pain, lameness, and discomfort for some days or weeks."[1]

Whitman says: "In the early stage of the disease the limp may even be intermittent, although it is probable in most instances some change from the normal gait may be detected by the practised eye."[2] Quite a number of works on orthopedic surgery do not mention the remittent limp.

These quotations are, however, sufficient to show that the remittent limp is not, as a prominent general surgeon once said to me: "It is a creature of your own imagination." On the contrary, it is a most important sign of the early stage of the disease, which, taken in connection with other signs and symptoms, enables one to establish an early diagnosis and in a certain number of instances to abort, or, at least, to shorten the course of the disease.

In the paper already referred to I also state as follows: "It has happened several times in my experience that the limp has disappeared without actual treatment while the patient was under observation."[3] This distinctly emphasizes Dr. Burrell's

[1] Treatise on Orthopedic Surgery. By Bradford and Lovett, second edition. William Wood & Co., New York, 1899, p. 222.

[2] A Treatise on Orthopedic Surgery. By Royal Whitman, M.D. Lea Brothers & Co., Philadelphia, 1901, p. 227.

[3] Op. cit.

statement, already quoted. I further remark: "I have watched these cases with much interest, and I have found that *the muscular protection of the joint did not wholly disappear as the limp did.*"[1] Indeed, in this essay I dwell at some length upon especially the diagnostic value of the reflex muscular spasm in tuberculous disease of the hip in all its stages. Some of the important views there expressed have been pretty generally accepted, if not adopted, by some of the recent writers on orthopedic surgery.

The important point, however, to be established is that a limp, whether accompanied by pain or not, in childhood, even if it has an apparently direct traumatic cause, should not be passed over lightly. It would be well if all parents knew that a slight limp may mean the first apparent stage of hip-joint disease, even if it should wholly disappear. I take occasion, both in my college lectures and in my lectures to the trained nurses at St. Luke's Hospital, to point out this fact, and I trust every member of this Association will make use of suitable opportunities to make the fact more generally known.

I venture, in this connection, to recite a bit of history: During the summer of 1872, while in my first provisional year of service as the orthopedic surgeon to St. Luke's Hospital, a patient, a girl of four years (L. G.), giving the history of a remittent limp, with slight muscular resistance in all directions, was under the observation of the late Dr. James L. Little and myself in the children's ward of the hospital. The symptoms were so slight and the disability was so trivial that Dr. Little questioned my diagnosis of hip-joint disease. As a matter of test, and at my suggestion, we administered ether, and the muscular protection of the joint disappeared, only to return, however, before the patient was wholly conscious and before we left the operating-room. Dr. Little asked me to explain this muscular phenomenon. I said: "The muscular symptom, as shown by the ether test, is a purely reflex affair, and the muscles are affected with a true reflex spasm." So far as I know, this is the first occasion where the term "reflex spasm" was applied to the conditions

[1] Op. cit.

existing in hip-joint disease. I certainly had never heard it used by anyone, and thenceforth I used the term "reflex spasm" in describing the condition now so familiarly known by us all. I know that Barwell with his acute reasoning mentions "neuro-muscular irritation and contraction" as being the factors which "fix the thigh at certain lateral and antero-posterior angles with the pelvis."[1] And he also refers to the "spasm of certain muscles" in connection with "the dull aching and with the sharp intermittent pain"—in other words, to the "spasms" which are "chiefly prevalent at night when the patient is sinking to sleep;"[2] but nowhere in his writings have I found any reference to the "reflex muscular spasm" as we understand it to-day.

I believe that the first real demonstration of the true nature of the reflex character of the muscular condition at the hip in hip-joint disease occurred in St. Luke's Hospital, under the condition named, in 1872.

While I feel privileged to make this statement, I shall always be glad to waive any claim to originality or priority.

[1] Op. cit., p. 430.

[2] Barwell, first edition, 1861, p. 308.

THE OPERATIVE TREATMENT OF HIP-JOINT DISEASES.

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PHILADELPHIA.

A THOROUGH consideration of the subject of the operative treatment of hip-joint diseases would occupy more time than is allotted to this paper. It will, therefore, be considered from the practical rather than from the scientific standpoint.

The subject may be divided into the operative measures employed for the relief of deformity and the surgical operations required in the treatment of arthritis. An extended experience in the management of cases of arthritis of the hip-joint has convinced the writer that in many instances operations may be avoided by early and efficient conservative treatment; the conservative treatment, therefore, is far more important than the operative. This fact is emphasized by the extreme rarity of the major operations in private practice—the writer having seen but one case in private practice that had been continuously under the care of the same surgeon, requiring excision—due to the better surroundings and improved hygiene with personal care. When operative measures are required they should be thorough and definite, and should be performed as quickly as is consistent with safety.

Under the operative measures for the relief of deformity are included (1) multiple myotomy and tenotomy, (2) forcible straightening, and (3) osteotomy.

1. *Multiple Myotomy.* When the ankylosis is of the false variety this method of treatment is frequently all that is required, particularly when the second method of forcible straightening is employed as an adjunct.

2. *Forcible straightening* by itself is not efficient for the relief of deformity in hip-joint diseases, and great injury may result if tenotomies have not been previously performed.

3. *Osteotomy* gives very satisfactory results in true or osseous ankylosis, and the necessity for it can frequently be determined by the skiagraph. Of the methods which are employed the Adams operation through the neck of the femur is seldom required, on account of the loss of the head and neck. The Barton or intertrochanteric operation does not give as satisfactory results as the Gant or subtrochanteric osteotomy. In performing the Gant operation it has been found more satisfactory to use the chisel, after the method of Maunder. In most instances it will be found satisfactory to make a lateral incision, particularly in children; but in adults it is sometimes better to make an anterolateral incision. In adults an oblique division of the bone is sometimes more satisfactory than a transverse section. In some instances the deformity is so great and the acetabulum has travelled so high that the case is inoperable, no known operation giving satisfactory results.

After osteotomy for the correction of deformity motion cannot be expected, as the limb is ankylosed in the corrected position. An attempt was made on one occasion by the writer at the Home for Crippled Children to make an artificial joint by removing a large wedge-shaped section from the surgical neck and trochanter. Motion was kept up for three days, but the result was not satisfactory, and the shock and pain were so great that the operation did not compensate for the risks that were taken. In cases of double ankylosis of the hip after osteotomies have been performed it is best to set the limbs in an extended position, so that the patient may walk about on crutches, although they cannot sit down well, rather to set the limb in a partial flexed or flexed position.

Under the operative measures for arthritis are included (1) aspiration, (2) incision (simple), (3) erasion (Willard), (4) excision, (5) amputation.

1. *Aspiration*, as an operative procedure, has not been found satisfactory, on account of the thickness of the pus and the presence of necrotic tissue. It is more satisfactory in synovitis

of the hip-joint, either for diagnostic or curative purposes, or as a prophylactic measure against future tubercular infection. The injection of iodoform emulsion after aspiration of the hip-joint has not been found satisfactory. In the small joints, as the elbow and the ankle, it is valuable; but in the hip it usually acts as a foreign body, and has to be subsequently removed.

2. *Incision.* In performing the simple incision of the hip-joint for the purpose of evacuating pus and examining the joint contents, the surgeon should always have permission to proceed to a more radical operation if this is found to be necessary. This will avoid delay. If upon making a simple incision the disease is so widespread that it cannot be entirely removed by curettage, unless a formal operation is to be undertaken, it is best to manipulate the sac as little as possible, but wash it out with bichloride solution after the method described in the early part of the last century by Gross.

3. *Erasion* of the joint, after the method of Willard, is favored in all instances when the disease is not extensive, and particularly during childhood. The erasion of the joint is accomplished by curettage of every part of the joint surfaces, the débris being carried away by the flow of sterile water through a canulated curette. All the sinuses should be freely opened, as well as the abscess cavities, and diseased tissues should be completely removed with the knife and scissors, after which the iodoform emulsion may be thrown into the cavity, and drainage provided. Erasion of the hip-joint is the preferable operation in children, even when the disease is quite extensive, and the results more satisfactory, and it does away with the short leg which is frequently met with after excision.

4. *Excision* of the hip-joint, whether partial or formal, is favored when the disease is extensive, particularly in adults. In performing excision of the hip-joint rapidity of operation, the use of an electrically heated mattress, and hypodermatoclysis will diminish the shock and reduce mortality. Rapidity of operation may be facilitated by planning before beginning to operate, by having a good corps of assistants, and by rapid and sure manipulation. Following the rule laid down by Ashhurst, excision was formerly considered equally fatal with am-

putation at the same point. With the improved technique of the so-called bloodless methods the mortality in the two diseases are equal only on account of the improvements in the technique of excision of the hip-joint, by rapidity of operation, conservation of heat, and hypodermatoclysis, already advocated.

Excision should only be performed in carefully selected cases, and should not be employed as a routine measure. The indications for excision are long-continued profuse suppuration from osseous disease and albuminuria. One very rare condition may be mentioned in this connection, and that is the separation of the cartilage by ulceration, only two such cases having been seen in the writer's experience; this is indicated by long-continued acute pain, unrelieved by every known method of treatment. The fact should always be borne in mind that excision was introduced by the Ferguson School as a substitute for amputation, which, at that time, was the preferred operation. The results of excision led to the disuse of amputation, and the writer regrets to see the present advocacy of amputation by many writers of the present day.

The incision which has been found most satisfactory is the curvilinear one of Agnew, behind the great trochanter. The Barker or anterior incision has not been found so valuable as was anticipated. If the disease is extensive it does not give sufficient room; but in the instances in which the disease is confined to the head and neck it has proven satisfactory, but drainage must always be provided posteriorly. In acute ulceration, producing separation, the Barker incision and the Adams osteotomy are very satisfactory.

5. *Amputation.* The writer does not favor amputation at the hip-joint for hip-joint diseases, except in very rare instances. If the disease has existed for a long time, and a very extensive disease of the ilium is present ; amputation is contraindicated. If the disease has extended down the shaft of the femur beyond its upper third, and the disease of the ilium is not extensive, amputation is indicated, and may be performed as a primary operation instead of excision, or may be used as a last resort after excision has failed. Illustrative cases of this kind have come under the observation of the writer, one of which, after

extensive disease of the femur following knee-joint disease, the hip-joint became infected, and amputation was followed by perfect result. In another one—extensive disease of the iliac bone and femur—amputation was declined by the writer, but was performed by another surgeon, the patient living but a week. The writer is therefore convinced that from these and other instances amputations should only be performed in very carefully selected cases.

The object of the present paper is to consider the subject of operative treatment of hip-joint diseases from the practical experience of sixteen years of careful and painstaking observation in the special department devoted to the treatment of these cases.

CONGENITAL DISLOCATION OF THE HIP.

By ROYAL WHITMAN, M.D.,
NEW YORK.

As I shall have occasion to refer to the obscurity in which the treatment of congenital dislocation of the hip is still involved, it seems proper at the outset to define my own position in the following propositions:

1. Congenital dislocation of the hip is a serious disability. The articulation is insecure, the static conditions are deranged, and the limb is shortened. Even if there were no increase of the discomfort or deformity to be feared, the limp alone as it is seen in childhood is quite important enough to merit any treatment that offers reasonable hope of success. The statement is often made that a dislocation is of comparatively slight consequence in females because of the concealment afforded by the skirts and because the part is not to be subjected to the strain of laborious occupation. But as this argument applies equally well to any deformity or disability of the lower extremities it hardly deserves special consideration.

2. Congenital dislocation of the hip can be absolutely cured both as to form and function. Such perfect cures can be expected only in cases treated at a seasonable time and in which excavation of the acetabulum has not been necessary.

3. The first essential of success is complete and permanent replacement of the displaced femur. Without such reposition functional cure is impossible.

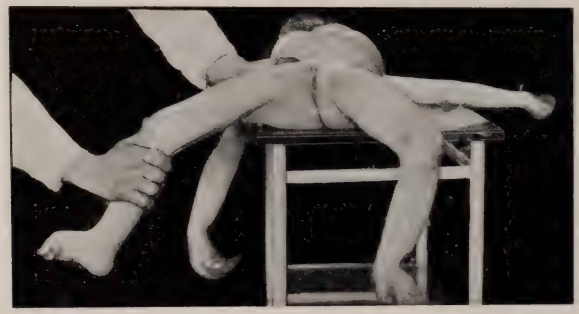
4. Perfect and permanent reposition by simple manipulative treatment alone must fail in a large proportion of the cases in which it is employed. This treatment must be supplemented, therefore, by one or other of the cutting operations. If excavation of the acetabulum is required a very considerable limitation

of motion is to be expected, but if the reposition is secure the ultimate result will be far better than that attained by anterior transposition of the head of the femur.

5. Manipulative replacement is the treatment of choice, and it is likely to supplant in great degree the older operation in cases treated at a proper age, when its details are better understood and when its limitations are recognized and removed by supplementary treatment.

It must have been the experience of everyone who has attempted to discuss or to describe this treatment, that it is difficult to make one's self intelligible by means of the terms ordinarily used to indicate attitudes of the limb. To illustrate: Let

FIG. 1.



Abduction and hyperextension.

a model lie upon his back on a table with the limbs extended and with inner borders of the feet in apposition. If now a student be asked to demonstrate the range of abduction he will move one limb away from its fellow in the same plane until the movement is checked by the normal muscular resistance. If asked to overextend the abducted limb he will carry it backward or behind the plane of the body. In this attitude, as may be demonstrated by means of a pelvis and femur, the neck of the femur lies in the plane of the side of the pelvis, the head of the bone pointing downward and slightly inward and forward. If now the thigh be rotated outward, the head of the femur will turn upward and forward to distend the anterior in place of the

inferior wall of the capsule. This student, if instructed to lessen the abduction, will carry the extended limb toward its fellow, which lies in the original position on the table; to flex the limb he must lift it upward or toward the ventral surface of the body. To him, therefore, Lorenz's description of the typical attitude in which to fix the limb after reduction of the dislocation as hyperabduction (to a right angle with the trunk), hyperextension (behind the plane of the body), and outward rotation will seem clear and definite because he interprets it from its anatomical standpoint.

The model having resumed the extended position, the right thigh is now flexed to a right angle with the trunk. If a second student is asked to demonstrate the range of abduction of the

FIG. 2.

Illustrating the range of normal abduction of the thighs, from the attitude of right angular flexion.

flexed thigh he will, of course, carry it directly outward to its limit. To hyperabduct he must force the thigh downward until it lies parallel to the table. This attitude of the limb he will describe as one of hyperabduction and flexion. To lessen the abduction he will lift the thigh ventralward; to lessen the flexion he will carry it downward toward its extended fellow.

It may now be demonstrated by means of the pelvis and femur that in this attitude the neck of the femur lies in the anteroposterior plane of the pelvis, a position identical with that resulting from what the first student calls hyperabduction, extension, and outward rotation. This confusion is accounted for in part by the difference in the manœuvres by which the position is attained, but principally by the unnatural or distorted atti-

tude of the limb. One must, therefore, understand the point of view of his audience or else discard the terms.

One may, for example, describe the typical attitude as one in which the thigh drawn up to a right angle with the body is forced outward until it lies in the plane of the trunk, or even somewhat behind it. And one may say of the after-treatment that the limb is gradually let down in the same plane, or carried somewhat forward, as the case may be. It is apparent, also, that when the normal position is approached the ordinary terms may be employed, as, for example, one would describe the ordinary attitude in disease of the hip-joint as one of flexion, abduction,

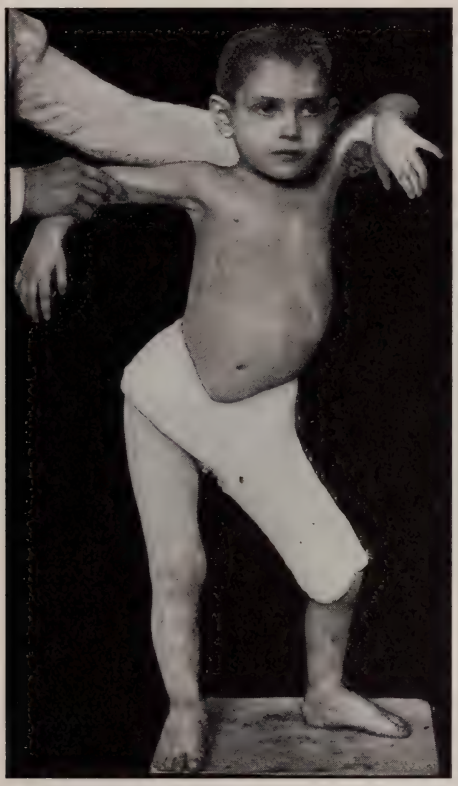
FIG. 3.

Illustrating the limitation of the range of abduction in bilateral dislocation. Compare with Fig. 2.

and outward rotation without fear of being misunderstood. The important points for consideration in treatment are, of course, the relation of the head of the femur to the acetabulum, and how it is influenced in this relation by the successive changes in the position of the limb. In the treatment of the congenital as well as of the acquired dislocation, one aims to retain the parts in normal relation to one another until there is no longer danger of redisplacement, the essential difference being that the undeveloped acetabulum and the lax capsule offer but slight support for the head of the femur. The distortion described as the

typical position for fixation of the limb is supposed to be essential in order to thoroughly stretch the contracted anterior border of the capsule and to place the femur in such a position that displacement is practically impossible.

FIG. 4.



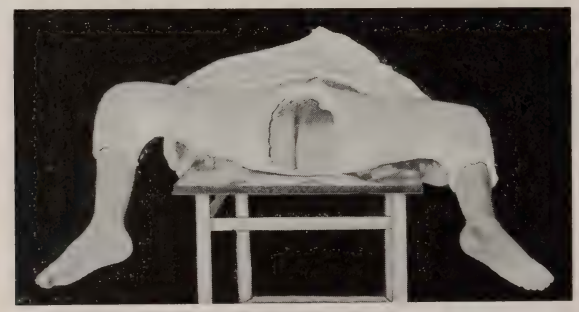
Unilateral congenital dislocation, showing the fixation bandage. A shoe with a cork sole about three inches in height should be worn on the operated side, while the attitude of exaggerated abduction is maintained.

It must be borne in mind, however, that the Lorenz treatment is founded on the theory that the acetabulum is rudimentary, and that its enlargement to a sufficient capacity is essential, and that this is accomplished by direct pressure of the head of the

femur in functional use. This is in fact the radical difference between it and the method of Paci which preceded it. At the present time we have no accurate knowledge of the time required for the deepening of an insufficient acetabulum and reconstruction of the cotyloid ring, if this be reconstructed. Failure by simple manipulative treatment is, however, more common than success, and it is probable that a considerable proportion of the successes in early cases may be explained rather by the presence of a sufficient acetabulum than by subsequent transformation.

If it be admitted that this transformation should follow functional use after reposition, then non-success must be explained by:

FIG. 5.



Bilateral congenital dislocation after reduction, the plaster bandage extended below the knees for more perfect fixation.

1. Failure to force the head of the femur through the constriction of the capsule and into direct contact with the acetabulum. At one time it was believed that the constriction supposed to be present between the acetabulum and the expanded capsule supporting the femur was in most instances an insurmountable obstacle; but it now seems probable in the light of clinical experience and of more recent autopsies that its importance has been exaggerated. If, however, a fold of capsule intervene between the head of the femur and the acetabulum there is a peculiar insecurity at the time of operation, and a subluxation is present when the first fixation bandage is changed. This is

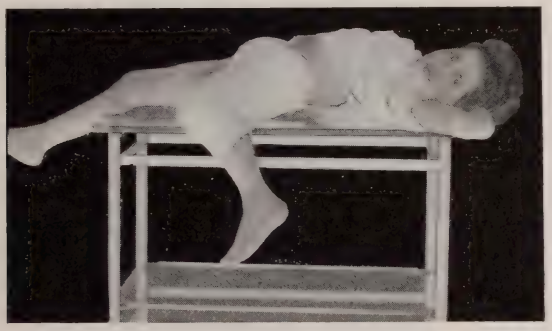
apparent to those who are experienced in palpation, and it may be demonstrated, of course, by an X-ray photograph.

2. Such malformation that adaptation is impossible, the most important of this class being a twist of the upper extremity of the femur, the so-called anteversion of the neck.

3. Failure in the process of natural transformation to assure a stable articulation.

An anterior twist of the femur sufficient to displace the head from the acetabulum when the limb is in normal position is usually present in primary anterior and supracotyloid displace-

FIG. 6



Abduction and inward rotation. The attitude preliminary to osteotomy in cases in which there is an anterior twist of the upper extremity of the femur.

ments, forms far more common than statistics indicate, and it not infrequently complicates the ordinary type also. In certain instances it is possible to demonstrate this by palpation or by an X-ray photograph before the operation; but in many cases its presence is not suspected until the normal position of the limb is again approached, when the subluxation appears.

Excluding these two causes of failure, which can be remedied only by arthrotomy and osteotomy, the class remains in which it would appear that the head at the time of operation is forced into contact with the rudimentary acetabulum and that the shaft of the femur is not twisted to a degree that prevents adaptation. Non-success under such circumstances must be ex-

plained either by failure to hold the parts in proper apposition or by insufficiency of the time allowed for adaptation or transformation.

In the erect posture the attitude in which the head of the femur is most completely in contact with the acetabulum is one of slight abduction flexion and inward rotation. This attitude is, therefore, the one which should be most favorable to the development of the shallow acetabulum of congenital dislocation. In the typical attitude of Lorenz, which is described as hyperabduction, hyperextension, and outward rotation, in other words in which the thigh flexed to a right angle with the body has been carried backward until it lies in the plane of the body, the head of the femur is forced forward so that it may be easily palpated in Scarpa's triangle. In this position there can be but bare contact of the upper part of the head of the femur with the acetabulum, and the pressure exerted can be but slight. It is assumed that this extreme position is necessary in order to prevent displacement and in order to thoroughly stretch the anterior border of the capsule, and in the ordinary routine of Lorenz's practice this position is often retained for from four to six months, or half the time, during which the fixation bandage is used. This would imply that the adaptation of the soft parts about the joint is of greater importance than the actual deepening of the acetabulum by direct pressure.

It seems to be the general impression that there is danger of redisplacement to the original position upon the dorsum of the ilium, whereas in the majority of cases the displacement is forward and upward, the first indication of failure being a slight lateral subluxation, so that the head of the femur can be felt to the outer side of the femoral artery. It is this very common experience that has suggested to me, in common with others, the advisability of fixing the thigh more effectively and in certain cases holding the head of the femur slightly internal to the femoral artery. This is what is meant by inward as distinct from outward rotation of the limb. The outward rotation described by Lorenz is no rotation at all from the operative standpoint, for, as is well known, the ordinary method of reducing the dislocation is first to overcome all contractions

by direct traction and by massage of the tense adductors. The thigh is then flexed to a right angle with the trunk, and the pelvis being fixed by the assistant, one exerts upward

FIG. 7.

The cure of congenital dislocation. The same patient is shown in Fig. 4.

traction on the thigh with one hand and with the thumb of the other pushes the trochanter upward. Thus the head of the

femur is lifted over the posterior and inferior margin of the acetabulum as the thigh is abducted. As the thigh is carried backward into exaggerated abduction the head of the femur is forced forward in some instances, showing as a distinct elevation below Poupart's ligament. Slight inward rotation, sufficient to turn the centre of the head slightly internal to the femoral artery, means, from the Lorenz standpoint, simply incomplete outward rotation, rather than inward rotation as opposed to outward rotation in the sense that it is used by Lorenz.

If this position of lessened outward rotation is thought to be desirable, and if one wishes to fix the limb more securely during the early stage of treatment, the plaster bandage must be carried below the knee, the leg being flexed upon the thigh to prevent rotation.

The attitude is somewhat more awkward than when the leg is free, and walking is somewhat more difficult, but, as has been indicated already, walking in the typical Lorenz position, in which the thigh is drawn up to a right angle with the body, can hardly deepen the acetabulum, because no direct pressure is exerted upon it. Better fixation is assured, and I am convinced that this is of advantage, particularly in the treatment of young children. When the second plaster bandage is applied, at the end of two to three months, one has an opportunity to test the security of the joint, and, if this permits, the limb may be lowered to a degree that will allow the patient to walk upon the foot without the aid of a high shoe. At this time the restraint is removed from the leg, and, if necessary, manipulation to overcome any limitation of complete extension at the knee may be employed. The aim should be to thoroughly stretch the anterior border of the capsule and to overcome all muscular shortening at the time of operation, and to fix the limb in the exaggerated position for a sufficient time to assure the adaptive changes in the capsule and surrounding muscles. In the after-treatment it should be placed in attitudes in which actual pressure of the two surfaces on one another is assured for a time that seems adequate for the development of the acetabulum. This time must vary with the age of the patient and with the anatomical condition of the parts. In some

cases, particularly those in young children, the stability of the joint is such that a cure is practically assured when the first bandage is changed, the acetabulum being of sufficient size, no transformation is required. But in older subjects, provided one is reasonably sure that the head of the femur has been forced through the capsule, and that anteversion of the femur will not prevent success, the period of adaptation should be very much increased. A year at least would not seem too long a time for this purpose.

Those who limit themselves to the bloodless treatment apparently believe that the final result of simple transposition of the head of the femur is equal to the best that may be attained by further operative intervention. This can hardly be admitted. It is well known that function can be greatly improved by fixation of the insecure articulation for a time sufficient to permit retraction of the capsule and muscles. After the support is removed there is, however, a gradual return to the original condition, and there is no reason to believe that the final result of operative transposition will differ in any essential from that of the primary anterior displacement, in which the limp is of the characteristic type, although less marked than in the ordinary form. To assure success, therefore, in the sense that it has been defined, the simple manipulative treatment must be supplemented in a large proportion of the cases by one or more of the cutting operations. These are osteotomy, arthrotomy, and excavation of the acetabulum.

The first procedure is indicated in those cases in which the upper extremity of the femur is so twisted that the neck points forward and slightly inward instead of inward and slightly forward. As is well known, there may be a very considerable deviation from the normal direction of the neck of the femur without apparent disability if the head is restrained by a normal capsule and cotyloid cartilage. In the absence of such restraint, however, even a moderate degree of anteversion is sufficient to prevent success.

This distortion is always present in anterior dislocations and in a certain number of cases of the other type also. Not infrequently the diagnosis can be made before treatment. As a rule,

however, the failure of treatment and the transposition of the head of the bone makes its presence evident.

If this distortion is known to be present the limb must be fixed after reposition in an attitude of inward rotation sufficient to compensate for the anteversion, the foot pointing, as a rule, directly inward. When the plaster dressing is changed at the end of two months or more this twist should be corrected.

The following is the method that I have employed:

A long drill is inserted through the trochanter and into the neck of the femur while the limb is held in inward rotation. The femur is then divided by the subcutaneous method just below the trochanter minor, or at the lower stub of the shaft, and, the upper fragment being fixed by means of the projecting drill, the shaft is rotated outward to the desired degree. A spica plaster bandage is then applied to include the foot, the position of the neck being assured by the projecting drill, about which the bandages are applied. This may be removed when union is sufficiently advanced to prevent redisplacement.

In many instances the operation is secondary to arthrotomy because one cannot be always certain that the distortion is the cause of non-success until the joint is opened. In the cases, therefore, in which failure is apparent after the simple manipulation, the joint should be opened by the anterolateral incision. By this means one can explore the acetabulum and test its capacity.

If a constriction of the capsule be present it may be overcome by incision and by stretching. The head is then replaced in the acetabulum and the incision in the capsule and in the superficial tissues is closed with sutures. One is then certain that there can be no obstacle to prevent functional transformation of the joint if the limb is fixed for a sufficient time in a proper position. If anteversion of the neck is present the limb is placed in inward rotation, osteotomy being deferred until the second dressing. These operations should not endanger the function of the joint, and, as has been stated, they are essential supplements of conservative treatment.

It seems probable that excavation of the acetabulum, which was formerly thought to be essential to success, will be more and

more restricted in its application. As importance of curative treatment is more generally appreciated, and as the disability becomes sufficiently familiar to practitioners to be recognized, as it should be when the child begins to walk, the percentage of success by the Lorenz treatment will be greatly increased, especially when it is supplemented by the secondary operative procedures that have been mentioned. The advantage of the original method of enlarging the acetabulum, provided, of course, that anteversion of the neck is not present to a degree to require osteotomy, is that it practically assures permanent reposition. Thus the long period of distortion required by simple manipulation may be avoided. Its great disadvantage is the persistent restriction of motion and the tendency toward distortion of the limb that accompanies it. The after-treatment usually advised has been to remove the support within a few weeks after the operation and to substitute passive motion and exercises. This is, I think, an error. Those who have had experience in the operation recognize the fact that motion which is comparatively free and painless when the plaster bandage is first removed usually becomes almost completely restricted within a week or more. For this reason I am inclined to think that the short Lorenz plaster support should be employed, not for weeks, but for many months, or until practical tests show that there is no longer tendency toward deformity. Such support should be preferably removable, so that massage and voluntary motion may be employed during the later stages of treatment. But so long as local sensitiveness and pain in use or motion are present the joint should be protected. As a general rule, it may be stated that the more perfect the replacement the greater the danger of restricted motion. In fact, in those cases in which this restriction is absent a certain degree of anteversion of the neck is usually present, sufficient to prevent direct contact with the acetabulum. In such cases stability is assured in part by the acetabulum, and in part by the thickened capsule.

In cases, therefore, in which excavation has been required or in which it has been performed, success is practically impossible unless the after-treatment or supervision is continued for years it may be. This may necessitate forcible manipula-

tion under anæsthesia to stretch contractions or to rupture adhesions.

As a rule the final results are satisfactory in unilateral displacements. A stable joint is assured with restricted motion, it is true, but the function is greatly improved, only slight limp remaining, which can be practically concealed by the older patients. One is, therefore, assured that the progressive shortening which is constant, and increasing distortion and disability which are often observed in adolescence, have been prevented.

It seems probable that in a certain proportion of cases of congenital dislocation of the hip the acetabulum is fairly normal at birth and continues to be adequate for several years. Only on this hypothesis can one account for the cases in which success is assured within a few months after reposition. In other instances the acetabulum is shallow and deformed, and the congenital inadequacy becomes more marked with age. The important question, as yet undecided, is whether such an acetabulum can be reformed by functional use. If it can be, then success simply requires attention to detail, more particularly the adapting of the treatment to the anatomical condition of the disabled part. At the present time more accurate statistics are essential.[1] Enthusiasts for the bloodless treatment are at pains to explain the distinction between anatomical and functional cures. Perfect function is, however, proof positive of anatomical cure, while a persistent limp is in a great majority of cases an indication of transposition. On the other hand, perfect reposition is by no means synonymous with perfect function. This is illustrated by the persistence of the limp whenever motion is restrained by adhesions or contractions.

Perfect functional success can be obtained only by the non-mutilating operations; that is to say, forcible reduction supplemented if necessary by arthrotomy or osteotomy. The results in cases treated by this method may be distinguished as follows:

(1) Perfect cures; (2) transpositions; (3) failures.

[1] As a contribution to authenticated results, I may state that at the May meeting of the Orthopedic Section of the New York Academy of Medicine, I presented ten patients cured by the Lorenz method. In all the cases sufficient time had elapsed to assure the permanency of the perfect cure.

The cases treated by the Hoffa-Lorenz operation may thus be classed: (1) Permanent reduction, with final results varying from practically perfect functional cure to ankylosis and deformity; (2) imperfect reposition, in cases of which there is often free motion, and the final result is usually somewhat better than after a simple transposition of the bloodless method; (3) failure, it being clear that after the open operation there is little excuse for complete failure. It may be stated that the statistics of the open operation, and to a far greater degree of the bloodless method, suffer because of the improper performance of the operations and the improper selection of the cases.

In conclusion, I may state that from further experience I am inclined to these opinions : (1) That the more complete fixation that may be obtained by carrying the plaster bandage below the knee after reduction, combined in certain instances with lessened outward rotation of the limb, is an improvement on the ordinary technique of the Lorenz operation in the treatment of young children; (2) that a longer period of fixation in an attitude approximating the normal is necessary to assure the remolding of the acetabulum in old subjects; (3) that arthrotomy and osteotomy must be regarded as necessary supplements to conservative treatment; (4) that the original Hoffa-Lorenz operation offers a prospect of a better ultimate result than transposition, and that it must therefore be held in reserve as a final resort after failure of the less radical treatment.

CONGENITAL DISLOCATION OF THE HIP; THE CAUSES OF RELAPSE.

By E. H. BRADFORD, M.D.,
BOSTON.

The difficulties of reduction of congenital dislocation of the hip have been sufficiently described, are well understood, and have been in most instances overcome.

Successful reduction of congenital dislocation of the hip is generally possible in children under ten years of age; but in the experience of surgeons, even the most skilful, relapses after successful reductions may occur. So-called transposition and functional success without anatomical reduction should be classed a surgical failure as far as reduction goes, even if the patient is benefited by the treatment received.[1]

For this reason a careful investigation of the causes of relapse is desirable. If the reduction is incomplete and the head not well passed in or through the capsular neck, a relapse naturally takes place; and it is also true that a relapse follows if the contracted short tissues which will check the free movement of the limb and produce dislocation or locomotion remain undivided or unstretched, or are only insufficiently stretched.

Why a relapse should follow after the head has been well placed in an acetabulum of proper depth is not well understood and needs careful study. The importance of the twist in the neck and shaft of the femur has not always been as carefully considered as it is important that it should be. In the normal condition the axis of the neck lies in the same plane as the cross axis of the femur at the condyle and at right angles with the axis of the foot pointed forward. When a twist is present this is not the case. If the neck and shaft of the femur are twisted

[1] Cordivilla. Zeits. f. Orthop. Chir., Bd. ix., H. 2, p. 123.

in such a way that in order to keep the head of the femur well in the acetabulum (*i. e.*, with the centre of the head against the centre of the acetabulum) it is necessary that the foot should be turned strongly inward, it is manifest that where the foot is turned out the head of the femur will be brought forward to and partly beyond the rim of the acetabulum. If the capsule is sufficiently strong, dislocation may not take place, as complete dislocation is prevented by the capsular ligaments. Where this is not the case the ligaments will be gradually stretched and the head of the femur will be forced outward and upward whenever the foot is turned out and held in any position other than a strong inward twist.

Where this twist in the neck of the femur is present when the individual is seated, it is impossible for the limb to be rotated inward, and the head of the femur is consequently pressed upward, and in the case of extreme twist is thrown out of the socket, causing dislocation, unless the capsule is sufficiently strong to retain the head in position.

That the twist of the neck exists in many cases of congenital dislocation has been pointed out by Nichols in a paper presented to the Orthopedic Association some years ago, and by Hoffa in his excellent work on orthopedic surgery. That it is common would appear to be the case from the examination of several cases which have come under my care in the last year, all of which presented this distortion, as shown by X-ray examination and on palpation. The existence of this twist is frequently overlooked for the reason that the position of the feet is not always noted with care during an X-ray examination. It is frequently found in a skiagram of congenital dislocation of the hip that the head appears to be wanting or rudimentary, for the reason that the foot was not turned inward sufficiently when the X-ray was taken. The limb is not sufficiently inverted, and owing to the twist of the neck and head the latter projects forward into the radiograph and is lost in the shadow of the neck or of the trochanter. This condition I have frequently discovered in comparing the appearance of the skiagram of the head and neck in congenital dislocation with the actual shape of the head found on cutting down upon the joint. According

to the radiographic picture a complete absence of the head or a marked distortion was to be expected, while an excellent head and well-shaped neck were found, when, on operation, the parts were revealed to view. This condition of things can be usually verified if a skiagram is taken with the limb in two positions, one a forced inward rotation and the other with the foot pointing upward. The disadvantage of this twist was well shown in a case which fell under the writer's care, where successful manipulative reduction was performed on a boy of four years of age. As a severe twist of the neck was suspected from an X-ray, the head was cut down upon, being held well in the socket during the operation. It was then seen that while the limb was strongly inverted the head remained well in the socket. If the limb was rotated outward, however, so that the foot pointed directly forward, the head of the femur rolled nearly out of the socket. If the foot was turned outward the head was twisted completely out of the socket.

In another case of a girl of six years of age, with congenital dislocation of the right hip, the skiagram revealed what appeared to be the absence of the head in the left, although on palpation it was evident that no dislocation was present, and practically a normal joint was present. On manipulation under ether, a twist of the neck was found on both sides, that of the dislocated side being the greatest. On the left side on rotating the foot strongly outward the head could be felt to project well to the outer side of the acetabulum, and on palpation under ether the rotation could be easily demonstrated. This, however, did not cause a dislocation, for the reason that the capsular ligaments were sufficiently strong to hold the head from rolling beyond the check of the cotyloid ligaments, the twist of the neck not being so great as to place the head entirely outside of the socket.

Where this condition exists it is manifest that no cure can result unless either the anterior lip of the acetabulum elongates to an unusual degree and the capsular ligaments around the head become sufficiently firm to hold the head in place, developing a real cotyloid ligament, or unless the twist is cured by growth. That the latter can take place is more than probable, for it is known that, according to Wolff's law, growing bones

shape themselves to new strains and positions, so it would seem certain that in growing children, under proper conditions, the neck would adjust itself and become shaped to normal conditions. This adjustment would require a considerable lapse of time and would explain the long period of treatment which Lorenz has said is necessary for the successful treatment of congenital dislocation. The alteration of the shape of the neck by growth and the adjustment of the head and neck in the acetabulum would seem as probable a result from long after-treatment as the absorption of the intervening capsular tissue under pressure, or a boring out or deepening of the acetabulum, claimed by Lorenz.

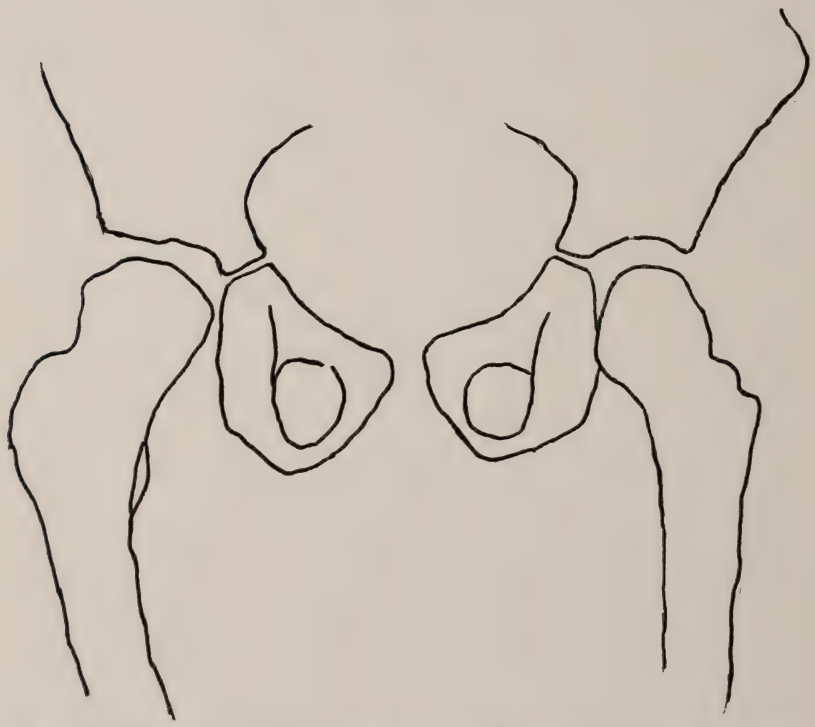
The importance of a twist in the neck of the femur as a cause of relapse has been carefully estimated by Schede, who has employed osteotomy of the shaft as a corrective. Schede recommends osteotomy below the lesser trochanter, and has driven a gilded steel nail through the head to hold it in place while the osteotomy is done. The nail remains several weeks and prevents redislocation while the healing of the bone is taking place. There is one great objection to this method, the annoyance caused by the nail.

The writer in several cases has used, instead of a nail, a knitting-needle with an end sharpened to a drill point. This can be bored through the skin and bone, if held by a hand clamp, and if thoroughly clean and free from rust, causes no pain and but little irritation. If the needle is passed through the bone and the skin on both the anterior and posterior surface, and is incorporated in the plaster-of-Paris bandage, the upper fragment is well held in place.

The writer has thought that the same benefit in correcting the twist would be obtained by osteotomy in the length of the shaft instead of directly below the lesser trochanter. Where this is done there is less difficulty in keeping the head of the femur in the socket if the fragment of the femur above the osteotomy is of sufficient length to allow of manipulation or fixation, not so easy where the fragment above the osteotomy is as short as when the osteotomy is done directly below the lesser trochanter.

Instead of osteotomy, the writer has made use of a Gigli saw, which is passed close to the femur at about its middle, or in stouter children just above the condyles. The bone is sawed three-quarters through its thickness, the Gigli wire is then removed, and the bone is broken. This will be found to endanger the position of the reduced head less than if the osteotome is used.

Fig. 1.

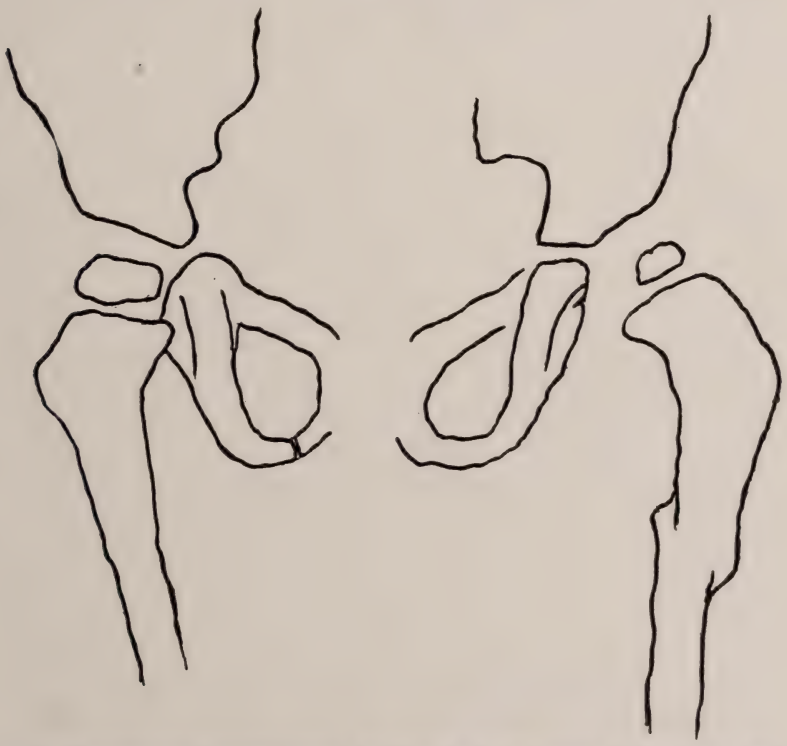


Reduced congenital dislocation of left hip, without twist in the neck and shaft. Tracing from skiagraph.

Instead of securing the head by means of a knitting-needle, which, although not involving serious complications, is an addition to the technical details, the writer has held the upper portion while the Gigli saw was used, and for a fixation under a plaster-of-Paris bandage, by means of a strip of adhesive plaster, which is wound spirally around the femur. The upper portion passing

beyond the trochanter is held by the assistant in such a way that it presses the trochanter upward. The lower end passes around the femur and prevents slipping. This should be so adjusted as not to constrict. During the use of the saw the femur is held by the hand of an assistant, so that movement

FIG. 2.



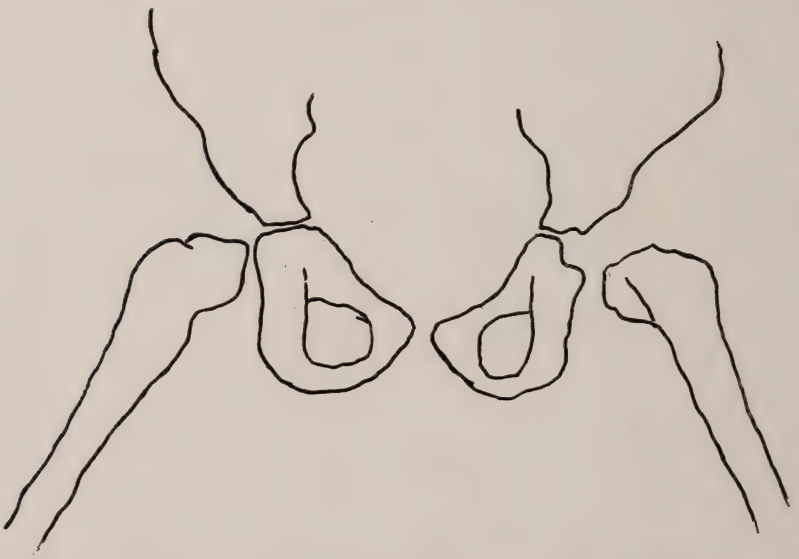
Double congenital dislocation of left hip, with the twist in the neck and shaft of femur, corrected by osteotomy of the shaft of the femur. Tracing from skiagraph.

sideways or up and down is impossible. The upper fragments of the reduced head are held from twisting by pulling upon the strap of adhesive plaster which presses the trochanter upward. The plaster strap can be left and incorporated in the plaster bandage.

As a means of dividing the shaft of the femur an instrument

manufactured by Ford will be found of use. An incision is made to the femur, which is held firmly by means of bone forceps. At the side of the bone forceps is a slot moving laterally on a pivot. Into this slot slides a chisel-shaped instrument with saw teeth at the cutting edge. This chisel is pressed upon the bone and is moved sidewise, rocking on the pivoted slot. The bone can be sawed through without an extensive dissection of the soft parts, but this method requires more dissection than if a Gigli saw is used.

FIG. 3.

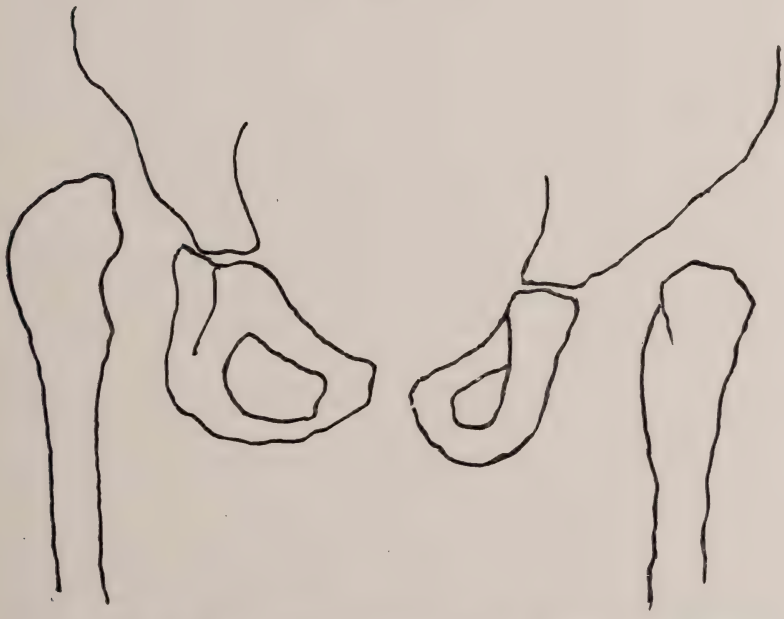


Reduced congenital dislocation of hip, with foot turned forcibly inward to overcome the twist in neck and shaft of femur. Tracing from skiagraph.

Among the hitherto undescribed causes of relapse the insertion of the tendon of the psoas muscle on the twisted shaft is to be considered. It is manifest that where this insertion is adapted to flexing the femur with a normal shaft the pull of the muscles will be toward eversion of the foot and redislocation when the head of a twisted femur is placed in the acetabulum. This condition can be cured by one of two ways: either by the adaptation of the soft parts to a changed position after reduction,

which will require a certain amount of time, or by operative interference. The latter is accomplished in the usual detail of operative reduction, when the lesser trochanter is freed from the capsular attachment. This also frees the attachment of the psoas and iliacus, and it is perhaps in part due to this that the percentage of relapses is less after reduction by operative interference than after manipulative reduction.

FIG. 4.



Same as Case No. III., with feet turned outward. Tracing from skiagraph.

Another factor, the value of which has not yet been determined is the condition of the capsule around the reduced head. It is manifest that if the cotyloid ligament is lax on the normal hip-joint dislocation, either partial or complete, is made more easy. After manipulative reduction the capsule remains more or less relaxed, and it will certainly take more time for firm tissues to take the place of the cotyloid ligament than after the cicatrizing processes which follow operative dissection. It would appear, therefore, that in doubtful cases there is less

chance for a relapse after operative reduction than after manipulative reduction, at the cost, however, of a more difficult procedure.

Anomalies in the shape of the head of sufficient degree as to prevent reduction or cause relapse occur, but are fortunately rare. One such presented itself in the practice of the writer where the head in a boy of five years of age existed only in a rudimentary projection of cartilage on the linea aspera. It is possible also that an abnormality in the plane of the acetabulum, causing it to face forward and be less adapted to hold a reduced head, may be a cause of relapse; such a condition has not yet been accurately described. In a case of operative reduction in a girl of eight years of age an undue and irregular projection from the posterior rim of the acetabulum appeared to check reduction, which was possible on its removal.

These changes in bone, however, are exceptional and in by far a large majority of cases are not to be considered as usual causes of relapse. These may be enumerated as follows:

1. The folding of the capsule in the acetabulum before the reduced head.
2. Insufficient stretching of the soft parts, especially the lower and inner portion of the capsule.
3. Relaxed condition of the capsule and muscles, including faulty attachment of the psoas.
4. Twist in the neck of the femur.

Where these conditions are borne in mind by the surgeon and corrected, as they can be, it may be expected that relapse after reduction of the congenitally dislocated head of the femur will be rare.

DISCUSSION.

Dr. Ridlon said that during the past ten years he had seen upward of forty cases of congenital dislocation. Some of them had been too old, in his judgment, to attempt the bloodless reduction, and some of them had refused such attempt. He had

operated upon a little more than half of them. In two or three instances he had tried two or three times, and had failed. His impressions of replacement were that something less than half that give the sensation and feeling of replacement, if kept for a long period well abducted, and were not brought down nearly to a comfortable walking position for twelve months, would remain, and that a small percentage of them would relapse into the former position after apparently having been fully replaced. He had had three cases that had passed into what is called the anterior transposition. The head lay where it could be seen as a slight protuberance in front of the joint, and can be felt by the fingers far more distinctly than it should in a normal joint. In one or two cases after walking upon it for a year or more the bone had remained in position, and the full normal length of the limb, or nearly its equivalent, had remained. There had also been a retention of nearly the normal amount of motion. In a case in which the first operation was done one year ago the thirtieth of last December, and had been without restraint since last August, flexion was not perfect; the child could lock the hands around the knee in a partially flexed position, and abduction was not perfect. Adduction and hyperextension were fully normal; outward rotation was fully normal; inward rotation was deficient. The full lengthening of one and a quarter inches, obtained at the time of operation, had been maintained in this child of four years. He believed that in all these cases an attempt should be made to replace the bone. In a child of fourteen or fifteen years of age, quite heavy and muscular, according to his experience, replacement had not been maintained. He believed replacement should be tried repeatedly, and all the force that one dared to use should be applied. He had anchored the pelvis and had had the combined pull of three men in the case of a child of four or five years of age. He had torn the upper adductors in two or three instances, and, after that, had done the manipulation for replacement. He was not sure to-day what manipulations were necessary for replacement. He believed his failures had been because full abduction to a right-angled position and full hyperextension, so that the knees were carried back to the median plane of the body or further,

had not been secured. He had not done the bloody operation in any instance, though he had assisted in one such operation of this kind. He felt that a joint replaced by the bloody operation was no more likely to stay in place than one replaced without such operation. It was beyond question that some relapse by the bloody operation, but remain where put; it was also beyond question, as shown by autopsy, that joints replaced by the bloodless operation do sometimes fully remain in place. As to whether one should follow Dr. Bradford's opinion in case of failure by the bloodless operation, and do the bloody operation in all instances, he could not himself accept this, although it was a matter of individual opinion. There might be a sensitive joint remaining not only for months but for several years, though why this should be he could not say. In a unilateral case a stiff joint or a somewhat sensitive joint for years was better than a congenital dislocation. There was an eminent neurologist in Chicago who had walked on a bilateral congenital dislocation all his life, and could make a running jump over a table very well. This man believed that bilateral congenital dislocation of the hip was not a disability and was not worth treating.

Dr. Sherman said he had been particularly pleased with the last two papers, as they were in line of his own views. Recently in Chicago he had seen a specimen exhibited by Dr. Edward H. Ochsner at the Chicago Medical Society which was phenomenal. The child had congenital dislocation of the hip, which had been reduced. For three years the child had absolutely perfect use of its limbs. It then died, and Dr. Ochsner obtained the specimen. The latter showed most beautifully the reproduction of anatomical and functional integrity. The ligamentum teres was absent, and this was the only gross deficiency from the normal. He had been in the habit of thinking of these cases in the light of a case of traumatic dislocation of the hip upon which he had once operated. In that instance a bloody operation had been done, the head had been put into the acetabulum, both being of normal shape, and after a period of one year, during which no manipulation was done, the joint was practically normal.

At the time of the dislocation the capsule had been torn entirely from the femur, and was found coiled up in the acetabulum. It was pulled out, poked into its place without any suturing and left to Dame Nature. In the light of that case he had stopped trying to suture the capsule in cases of congenital dislocation upon which he had done arthrotomy. Some of the members had heard him speak about the reduction of a congenital dislocation through a simple incision so as to be sure that there was no interposed capsule. In these cases he had obtained a certain measure of success not secured in the others. As regards deepening the acetabulum, it was something that might have to be done, but it was to be deprecated because of the resulting stiffening. If, however, the stiffness was let alone, and the child was allowed to walk, there would be an increase of motion without any traumatism being inflicted. The rigidity was the result of traumatism, and was not due to a pathological process. As to the causes of recurrent dislocation, the speaker said that the classification given by Dr. Bradford could not be improved upon. They might be summed up as "anatomical misfits." There was a twist in the shaft of the femur, or a misfit capsule which was interposed between the head and the bone. This classification was a rough one, but a true one when considered in connection with the traumatic dislocation. He quite agreed with Dr. Bradford that the subject was one to which should be given the greatest attention. He knew of three women in San Francisco, one young and two old. One of the latter was forty-five or fifty years of age, and was practically confined to a chair. One of the others was a married woman of thirty years, with children, and getting very stout and unable to walk. The physician referred to by Dr. Ridlon is of light build, and was proportionately agile.

Dr. Elliott referred to the production of anterior transposition of the head of the femur following successful reduction in two instances of his practice, due, he believed, to too great pressure of the plaster spica posteriorly. When the patient began to work, the leg and thigh, acting as a powerful long arm of a lever upon this as a fulcrum, threw the head anteriorly. This was proven by removal of the bandage, reduction of the

head of the femur, and its subsequent retention in the acetabulum.

Dr. Whitman said he had never had a case relapse that had once been classed as cured by the bloodless method.

Dr. Bradford, in reply to Dr. Ridlon, said that he understood that a certain number of cases could be reduced by the bloodless method, that in a certain number of cases the deformity relapsed, and he believed that if the deformity relapsed it should be cut down upon. If the head had been put in and slipped out, there was some reason for it. Anatomical and pathological evidence showed that a certain number of cases were not really, though apparently, reduced, because the capsule is folded up in front of the head. Admitting that there were such cases, it is advisable to open the capsule and put the head into the acetabula.

Dr. Whitman explained that there had been no relapse after he had discharged the patient from treatment, having been satisfied that the case was cured. He had, of course, seen many displacements during the course of treatment after apparent replacement at the time of operation.

ARTHRITIS DEFORMANS.

By E. H. BRADFORD, M.D.,
BOSTON.

The purpose of this paper is to call attention to the need of more thorough study of this affection.

The disease is more prevalent than cancer, and at times less merciful, as it is slower in its torture; it is the curse of old age, robbing it often of the contented philosophy which is its right, as joyousness is of childhood, and yet so little is really known of the disease that the very name is a subject of dispute.

The term arthritis deformans is used here, avoiding the other aliases of a disease so varied in its manifestations.

The morphology of this disease is so little understood that a name without a pathological basis seems, in our present knowledge, preferable.

Dissimilar processes may be, in our present ignorance, grouped under one head, as greatpox and smallpox once were, or some of the varying manifestations of this polyform disease, by some considered symptoms of distinct diseases, may, like the phases of syphilis, be the result of the same process.

The group of symptoms classed under the term arthritis deformans may be said to be characterized by alterations in the structure or shapes of the ends of the bones forming the joint, a loss of elasticity of the capsule and capsular ligaments, with local swelling or atrophy, with and without attacks of pain. These symptoms are often popularly regarded as due to previous errors in diet or an inherited dyscrasia, and are confused frequently with gout, an opinion perhaps based partly on the fact that faulty metabolism may be the principal cause in both affections.

The fact that the joints are attacked and often painful has given currency to the belief that the disease is a form of

rheumatism, and the term chronic rheumatism is the one most commonly used, while the word rheumatoid has been applied, suggesting a belief that the process is not rheumatic but something like it. To add to the confusion the suggestion is made that the affection is of bacterial origin.

While many writers believe that the disease is a manifestation of a disease of the nervous system, the current literature of this subject gives evidence of the lack of unanimity in the mind of the profession as to the nature of the disease.

A list of articles published in medical journals in the past year on arthritis deformans is sufficient to show the direction of medical thought and that searching investigation of the nature of this disease is needed and will be welcome.[1]

[1] Kelly, A. O. J. "Arthritis Deformans, its Clinical Features, Differential Diagnosis, and Pathogenesis." Journal of the American Medical Association, Chicago, 1900, vol. xxxv. pp. 1618–1625.

Bain, William. "Observations on the Excretion of Nitrogen in Rheumatoid Arthritis." Transactions Clinical Society, London, 1900, vol. li. pp. 124–127.

Bailey, G. L. "Etiology and Treatment of Rheumatoid Arthritis and Allied Affections." Cincinnati Lancet-Clinic, 1901, n. s., vol. xlvii. pp. 27–30.

Hawthorne, C. O. "Rheumatoid Arthritis with Mitral Disease." Clinical Journal, London, 1900–1901, vol. xvii. pp. 184–188.

Kerr, J. G. D. "Rheumatoid Arthritis." Journal of Balneology and Climatology, London, 1900, vol. iv. pp. 279–289.

Parker, D. "Observations upon Diseases under the Heading Rheumatoid Arthritis." St. Bartholomew's Hospital Reports, 1900, vol. xxxvi. pp. 178–194.

Hoke, Michael. "The Treatment of Osteoarthritis and Rheumatoid Arthritis of the Feet, Knees, and Spine." Atlanta Journal-Record of Medicine, October, 1900.

Latham, P. W. "The Pathology and Treatment of Rheumatoid Arthritis." Lancet, London, 1901, vol. i. pp. 998–1005.

Moncorro. "Polyarthritis Deformans in Infancy." Apropos of a new case observed in a boy five and a half months old. Interstate Medical Journal, St. Louis, February, 1901.

Neuman, F. "The Treatment of Sciatica and Arthritis Deformans." Report of the Tallerman Treatment from the Grand Ducal "Landesbad" at Baden-Baden. Medical Press and Circular, London, 1901, n. s., vol. lxxi. pp. 385–388.

Tull, M. G. "Report of a Case of Arthritis Deformans Successfully Treated by the Application of Ice to the Spinal Column." Proceedings of the Philadelphia County Medical Society, Philadelphia, 1901, vol. xxii. pp. 133–136.

The affection is observed in children, and Tschernow[1] finds that the affection in childhood begins either with an acute or a subacute onset. A marked distinction, however, is to be observed between this and real rheumatism in children, which is not accompanied or followed by deformity or the development of bone exostosis. Heart complications were found in nine of the forty-nine cases observed by him.

Characteristic of the affection in children are hypertrophy of the epiphysis and atrophy of the diaphysis, destruction or fibrous degeneration of the cartilages, alteration of the synovial membrane, and early muscular contraction.

In 400 cases the affections were found to vary in age of onset from one year and four months to twenty-five years.[2]

Although clinically the diseases are distinct, pathologically the early changes in acute rheumatism are the same as those in rheumatoid arthritis.[3]

Certain disturbances of metabolism have been found in a diminution of lime salts and earthy phosphates in the urine, diminution in the excretion of uric acid and urates, without disturbance of the normal relationship between the uric acid and the alloxan bases.[4]

Murdock, F. H. "The State of the Gastric Secretions in Chronic Rheumatism and Rheumatoid Arthritis." Medical News, New York, 1901, vol. lxxix. pp. 166–168.

Moncorro. "Sur la polyarthrite deformante dans l'enfance a propos d'un nouveau cas observe chez un enfant de sinq mois." Rev. mens. des mals. de l'enf., Paris, 1901, vol. xix. pp. 314–326.

Nelson, W. H. "Rheumatoid Arthritis." Interstate Journal of Surgery, New York, 1901, vol. xiv. pp. 201–203.

Whitman, R. "Spondylitis Deformans." Reference, Medical Times and Register, Philadelphia, 1900, vol. xxxviii., pp. 234, 235. Reference, American Practitioner and News, Louisville, 1900, vol. xxix. p. 427. Reference, Journal of Medicine and Science, Portland, 1900, vol. vi. p. 340.

West, S. L. "Chronic and Villous Arthritis." Philadelphia Medical Journal, 1900, vol. vi. pp. 1143, 1144.

[1] Centrbl. f. Chir., August 30, 1898, p. 853.

[2] Delcourt. "An Autopsy." Revue mensuelle des maladies de l'enfance, July, 1898, p. 329.

[3] Lebert, Ranvier, Kusmaul. Quoted by Parker. St. Bartholomew's Hospital Reports, 1900, vol. xxxvi. p. 177.

[4] Kelly. Journal of the American Medical Association, December 22, 1900, p. 1618.

Bain[1] reports a diminution in the uric acid secreted. The phosphates were found to be markedly diminished, and the variation in their secretion closely follows that of the uric acid.

Examinations of the contents of the stomach have been made by Murdock,[2] but without determining any causal relationship between the stomach contents and the disease.

The neural theory in explanation of arthritis deformans, first brought forward by J. K. Mitchell, has certain facts to support it. A nervous condition seems to accompany the affection in many instances, but whether as a cause or an effect is not determined.

Irwin[3] reports a case in which the affections of the joints were changed a few hours after menstruation. All pains and swelling in and about the joints disappeared, except Haygarth's nodosities and Heberden's nodes. The joints became supple and the movements were not as painful. The relief to the joints lasted from two to four days, after which the swelling and pain returned.

This, however, is not the usual course of the affection, and it is a question whether the neural element may not act simply as a disturbing cause in the chemistry of metabolism.

Painter[4] is of the opinion that a marked distinction exists between rheumatoid arthritis and osteoarthritis, the latter being characterized by bone formation.

This opinion is not held by Garrod,[5] although he regards the rheumatoid and osteoid form of arthritis deformans as different as does Goldthwait in a valuable article presented to the American Orthopedic Association.

Pathologically the affection may begin as a simple synovitis, with slight effusion, accompanied at first by injection of the synovial membrane and later by development of red, soft, villous growth or irregular folds or a network of growths. This process is either dry or there is an effusion of a small amount of synovial fluid, or the development of a jelly-like exudation, and a thin

[1] Transactions of the Pathological Society of London, vol. xxi. p. 124.
[2] Medical News, vol. lxxix., No. 5, p. 166.
[3] American Practitioner and News, vol. xxxi., No. 9, p. 25.
[4] Boston Medical and Surgical Journal, November 23, 1901, p. 593.
[5] British Medical Journal, October 12, 1901.

fluid. Thickening of the capsule takes place with a fibrous degeneration and absorption of the cartilage. There is a thickening and loss of elasticity of the periarticular tissues, which may lead to a loss of motion, fibrous and, later, bony ankylosis, and a complete synostosis.

The synovial membrane is at first softened, the villous growths, originally reddish, become more thick, tougher, and yellowish-red in color, and these villosities may cover the whole inside of the joint up to the edge of the cartilage. Cartilaginous bone deposits are formed in the fringes with more or less fibrous changes and bone deposits, or the development of cartilaginous or osseous loose bodies. There is an apparent erosion of the bone tissue, followed in places by fibrous and osseous changes, the periosteum, ligaments, and muscles are all altered, exostoses are developed, and the joint is materially altered either in the direction of stiffness or in the direction of laxity.

The alterations found in bone are readily studied in the joints in animals, and considerable attention has been paid to the histology of these changes.

Opinions vary whether spavin (arthritis deformans of man) commences peripherally, as a periostitis, or centrally, as an osteoarthritis of the hock bones.

Harger,[1] after an examination of forty specimens, found that in seven there was no exostosis occult, although there was firm ossification and ankylosis of various bones.

In all cases accompanied by exostosis the internal lesions were well advanced, and in no case, excepting one, and this was extremely doubtful, was there any peripheral deposit with a normal state of the articular surfaces.

"Spavin seems to develop eccentrically, beginning with the internal bony structure and the articular surfaces."

We cannot deny the probability of spavin commencing as a periostitis in cases of traumatism; but this is not the general mode. Ringbone may be articular or periarticular.

In the former the process is as follows: In the compact bone tissue a short distance under the articular cartilage a rarefying

[1] Journal of Comparative Medicine, March, 1902, p. 133.

osteitis takes place over an area appearing in transverse sections as large as a pea. The bone tissue becomes absorbed, leaving a cavity filled up with a more or less soft embryonic tissue and bloodvessels. The process extends gradually toward the articu-

Fig. 1.

Spavin. (Warren Museum.)

lar cartilage, which becomes ulcerated over irregular areas and desquamates, as is frequently seen in cases of osteoporosis, constituting an osteoarthritis. The inflammatory zone of the bone now becomes the seat of a condensing osteitis (osteosclerosis). The soft, vascular, embryonic material now becomes

organized, infiltrated with calcareous matter, and converted into condensed and compact bone. The articular cartilage of the opposing bone at the point opposite the articular ulceration of the bone first affected likewise commences to ulcerate, and

FIG. 2.

Wet specimen, fibrous synovitis, beginning arthritis deformans. (Warren Museum.)

leads to an osteoarthritis at that point. The two articular ulcerations being contiguous, will finally form adhesions and become ossified.

In the periarticular form the exostosis develops upon the periphery of the bone. It is an osteoperiostosis. It commences

as a rarefying and then passes into a condensing osteitis of the superficial or subperiosteal layers of the compact tissue of bone, which is communicated to the periosteum and provokes a periostitis. The result is a bone tumor of variable dimensions.

The exostosis of the ends of two contiguous bones may become ossified, forming a peripheral or false ankylosis, while the articular surfaces themselves may retain their normal state.

The structure of an exostosis differs slightly from normal bone. It is more porous. The Haversian canals are larger and filled with embryonic tissue, the cells are less numerous, and its earthy salts are less abundant. The ligaments and the synovial membrane also show inflammatory ulcerations.

Bade[1] has examined a number of specimens of arthritis deformans with the Röntgen rays and found that there was a concentric atrophy in which the normal large trabeculæ found in the neck and head are pressed nearer together. There is also another form, a concentric hypertrophy, in which the normal structure is preserved, but the trabeculæ seemed pressed apart. There is an irregular atrophy and hypertrophy in which there is unequal diminution and increase of the bone. The diminution of the bone is found more in the periphery of the hand. In the hollow of the neck the increase is found on the shaft between the trochanter major and minor. A new system of radial support is formed.

The pathological and anatomical characteristics observed in arthritis deformans are so varied that they present a long series of structural alterations. These are found especially in the tissues of the cartilage, bone, capsule, and periarticular tissue. This series is so interlaced that it is difficult to find in some chronic cases a basis of pathological classification between villous arthritis on the one hand and myositis ossificans on the other.[2]

The changes summed up in the following terms indicate the multiform character of the series:

Arthromeningitis catarrhalis serosa.

Arthromeningitis serohemorrhagica fibrinosa.

[1] Zeitschrift f. orthopädische Chir., Bd. ix., Heft 2, p. 207.

[2] Kitt. Pathologische Anatomie des Hausthieres, vol. i. p. 325–328; also, Münchener Jahresbericht, 1884–1885, p. 72.

Synovitis fibrinosa sicca.
Synovitis serosa chronica proliferans.
Synovitis chronica proliferans et ossificans.
Arthritis erosiva pannosa.
Arthritis erosiva pannosa et ossificans.
Arthritis ossificans.
Arthritis ossificans et ankylosans.
Osteitis ossificans.
Myositis ossificans.

The arrest, self-limitation, or temporary check of the disease is as characteristic as its chronicity; its frequent tendency to remain stationary for a long period is as noticeable as the variety of its pathological manifestations.

That arthritis deformans is very common in old age is so well known that it needs no discussion; but its prevalence is much greater than is supposed. Out of sixty-six men between sixty and eighty years of age in the Long Island Hospital and Almshouse, twelve showed manifestations of arthritis deformans, interfering with activity. Although none of these were bed-ridden, one of them was so thoroughly crippled in many joints as to be almost helpless. It was curious to note that all were unaffected in the hands; none had Heberden's nodes. One had a knee and shoulder affected, one an ankle, one a hip and knee, one a shoulder, two many joints, and one a wrist.

In the women's department of the same almshouse, however, out of twenty-six patients only five had affections of the larger joints, while twelve showed affections of the hands.

Why the hands of men should be exempt from this affliction and those of women affected has not as yet been answered.

Looking at the affection as it is seen clinically it is as polyform as might be expected from the varied pathological changes.

The disease may begin in childhood in such a way that it is mistaken for tubercular disease, as in the following cases:

H., a child of three years of age, was a healthy baby until she complained of a slight pain in her left knee with slight constitutional disturbance, and swelling and pain in the right knee, which were followed by pain in the other. There were

constitutional disturbances and the right hand became involved. The pain became very severe, but gradually subsided. A year later the hips, knees, ankles, right elbow, right hand, and cervical spine and jaw were involved; muscular strain and great sensitiveness. This condition has remained for two years, with subsidence. There were enlargements of the tissues above these joints; but no new bone formations were discovered under X-ray examination. Distortions of the lower extremities have been prevented by bandaging and traction. At present there is slight motion of the lower jaw, and the respiratory movements of the chest are normal; stiffness of the hips, knee, and ankle, with muscular twitching. The knees present hard globular swellings with slightly increased surface temperature. Slight subluxation; back and toes are congested and swollen, as are also the fingers. The spine is entirely rigid. In this case the onset was gradual and was considered to be tubercular by the physician in charge.

R., a child of five years of age, was noticed to limp slightly, with swelling, first in the left knee, a slight subluxation, and little effusion. Later his right knee showed the same symptoms. This condition lasted for six months, with improvement under treatment of the right knee, which became entirely well. The left knee, after two years, recovered, retaining normal motion; but some swelling persisted. The child has remained well for nearly two years.

S., a child of five years of age, was attacked with gradual swelling in the left knee, both elbows, wrist, and neck. There was but little pain, but stiffness and distortion existed, with enlargement of the periarticular tissues. There was a gradual increase in the symptoms, and the patient was considered to be tubercular. After six months' treatment the patient recovered completely after a persistence of the affection for a year. The cure remained permanent a year after the recovery, since which the patient has not been heard from.

N., a child of twelve years of age, was attacked in the left knee with symptoms resembling the ordinary tubercular

arthritis. A few weeks later the other knee was attacked, and gradually all the joints and many of the smaller ones became involved. There was extreme pain and sensitiveness, which persisted for a year. The pain has gradually diminished, but the patient has remained crippled, with distortion and stiffness of all the important joints.

The treatment was equally thorough in the two cases which did not recover as in the cases of the two that did. The symptoms of the cases of the two which recovered were, however, less acute. The general condition and surroundings of these patients were good in all cases.

The two cases following represent the disease beginning in a similar way, but with entirely different results:

T., a young man of seventeen years of age, of rapid growth, complained of a puffy condition, with slight pain of the knees and ankles. The symptoms were not acute and improved slightly, never disappearing entirely. A year later other joints became involved, and ultimately permanent ankylosis of all the important joints followed.

W., a rapidly growing boy of sixteen years of age, presented himself with swelling, thickening, and slight effusion of both knees without pain. The condition remained stationary for two years and gradually improved, but became worse after a fall, disappearing almost entirely a year later. No stiffness or limitation of motion followed. The treatment in both these cases was similar, and no apparent reason for the recovery in one case and the lack of it in the other could be determined.

B., a lady of twenty-five years of age, became gradually stiffened in the majority of the larger joints. No acute attack existed, and she remained in a crippled condition for several years without change. There were occasional attacks of pain, with a swelling of the joints, which subsided, and her condition remained unchanged for eight years. She is able to go about her room with difficulty, but without pain.

D., a similar case to this, attacking a lady of forty-five years of age, of apparent good health. Progress of the affection was insidious and accompanied by attacks of painful contraction of all the large joints. There was great distortion of the hands and fingers and contraction at the hips and knees. The patient became an habitual morphine taker and her symptoms gradually increased. Cessation of the pain finally followed with stopping

FIG. 3.

Bone of badly deformed hand, arthritis deformans (Warren Museum.)

of the morphine habit. The patient died of exhaustion after an illness of ten years.

L., a woman of thirty-five years of age, with symptoms similar to those of the previous case, but yielding to treatment

by correction under an anæsthetic and plaster-of-Paris fixation, until the patient was able to walk about the room without a cane, and with a cane could walk in the street. Gradual improvement was noted for a year.

P., a lady of thirty-five years of age, with involvement of stiffness, which has persisted for ten years, of the knees, hips, wrist, arm, elbow, and ankle, thumb and first finger of the left hand, and all the fingers of the right hand. In this instance the patient after forcible correction and plaster fixation was able to walk about the house without cane or crutch and to walk a short distance in the street without a cane.

The following three cases of middle-aged ladies resemble each other in general appearance and condition, but vary in their symptoms, as follows:

The first, after a period of slight pain and discomfort, which was treated for rheumatism at several health resorts, gradually developed a laxity of the lateral ligaments of the right knee. There was no pain, but some swelling of the soft parts existed, with enlargement and a puffy condition of both knee-joints. This gradually increased until the patient was unable to walk without the use of a crutch, and required the use of an apparatus which enabled her to walk without crutches. No improvement in the patient's condition has developed during five years of observation.

In the second instance the symptoms were seen in the left foot under a skiagraphic examination. Exostoses were found under the os calcis and at the lower end of the tibia.

In the third instance marked enlargement of the bone of the knee was observed, with pain stages, but without the development of laxity of ligaments; the patient walked with difficulty with the help of a cane, becoming gradually worse, needing a fixation apparatus, accompanied by occasional attacks of severe pain.

In a similar case, presented by an older lady, the bedridden condition gradually improved, and the patient is able to walk about freely with the use of a cane, although there is no laxity of the ligaments and but little enlargement of the bone.

In several of the above instances improvement apparently followed treatment, but in many the affection seemed to follow its course unaffected by treatment. It is clear that in an affec-

FIG. 4.

Bone of badly deformed hand, arthritis deformans. (Warren Museum.)

tion where arrest of symptoms and a long-continued freedom from exacerbations are as characteristic as the variety of parts attacked the exact connection between the natural limitation of the disease and the result of treatment is not easily determined.

In spite, however, of our ignorance as to the nature of arthritis

deformans, the records of treatment show one of apparent benefit in many instances from measures which meet the therapeutic indications which present themselves.

That which improves the patient's general condition improves the patient's local symptoms in this as in other general disorders. Motion of a joint, if protected from strain, improves its condition, as it is a normal function. Improvement will result if contracted joints are straightened and placed in a condition where moderate motion is possible.

Measures to improve the circulation, viz., heat and cold (dry and moist) and static electricity, may be regarded as measures checking the advance of the affection or in establishing an arrest of the process.

The prognosis is by no means a prognosis of despair. The arrest of the disease by the natural processes is to be regarded as a stimulus to investigation and the varied manifestations of the disease a challenge for renewed observation.

Arthritis deformans may be regarded as an affection of the organs of locomotion characterized by a fibrous degeneration of synovial membrane, ligaments, bones, cartilages, periosteum. This causes an impairment of elasticity, an alteration in shape, and stiffness, and is followed by osseous degeneration, bony ankylosis, and irregular bony deposit.

The question suggests itself whether these changes are similar in nature to those which produce fibrous degeneration elsewhere, notably arterio-sclerosis, and for improvement in our methods of treatment should we not look for investigation which will throw light upon the causes of fibrous degeneration and of osseous metamorphosis?

What is needed is more complete pathological reports of the condition of all organs and the whole body in arthritis deformans through investigations of the changes of tissues in the milder stages of the disease.

Accurately recorded facts in regard to the arrest of the affection and the apparent self-limitation or long-continued arrest of the disease.

Careful chemical investigation of the changes of tissues affected.

Careful examination of the chemistry of the blood in cases of early and late cases of arthritis deformans.

Careful examination of all the excreta, including perspiration and respiration, and careful, thorough metabolic investigations in cases suffering from the affection.

All this is needed before the affection can be placed upon a satisfactory scientific basis.

THE TREATMENT OF LATERAL CURVATURE.

By E. H. BRADFORD, M.D.,
BOSTON.

The proper treatment of lateral curvature is difficult, not because of any pathological state to be altered, but because the conditions necessary for complete success are not readily obtained. In knock-knee, where an undue prominence of a condyle prevents the correction of a deformity, this can be obviated by osteotomy, if the bone is firm, or otherwise in growing children by the constant use of an apparatus determining proper growth by correcting pressure. This difficulty makes corrective treatment of advanced cases of scoliosis impossible, as osteotomy is not feasible in lateral curvature, and the amount of pressure necessary for altering the shape of grown bones in the trunk is so great that correction becomes impossible.

It is this which has given to many surgeons the impression that a scientific treatment of scoliosis is impracticable. Granting that this is true in many instances, there remains a large class of cases among growing children demanding treatment, which should be effective if thoroughly applied. If the lower jaw can be moulded into an improved shape there is no essential impossibility in correcting a projecting shoulder or hip in growing children, provided the conditions necessary for treatment are not impossible.

The surgical indications for the treatment of lateral curvatures are now well understood. It is generally agreed that where the muscles are weak and a faulty attitude favored by weak muscles, the muscles should be developed.

Where the ligaments are shortened they need to be stretched or made more elastic by such correcting measures as can be used.

Where alteration in the shape and position of the bones have taken place the spine should be held during the growing period as near the correct position as possible.

That during the growing period faulty attitudes should be prevented by retaining apparatus, if necessary.

The question for the practitioner is that of the application of these principles.

In other words the practitioner needs to consider:

1. Measures to promote flexibility in a localized position of the spine. Means for the greatest possible rectification of errors.

2. Gymnastic exercises for the development of such muscles as may be needed in given cases to maintain a corrected attitude.

3. Appliances preventing faulty positions of the spine.

4. Means of recording the condition and progress in cases.

While elaborate apparatus is often of value in giving the greatest possible precision, it is manifest that the greater the elaboration the less general is the applicability of such apparatus. The practitioner needs the simplest possible measures which may be regarded as efficient. .

In practice the cases may, for convenience, be classified as follows:

Cases needing correction, demanding considerable pressure and the use of a removable jacket, with or without exercises.

Cases requiring flexibility and passive exercises, conducted by the surgeon or nurse.

Cases suitable for flexibility exercises done by the patient.

Cases needing developing exercises, measured by graded work and strength tests.

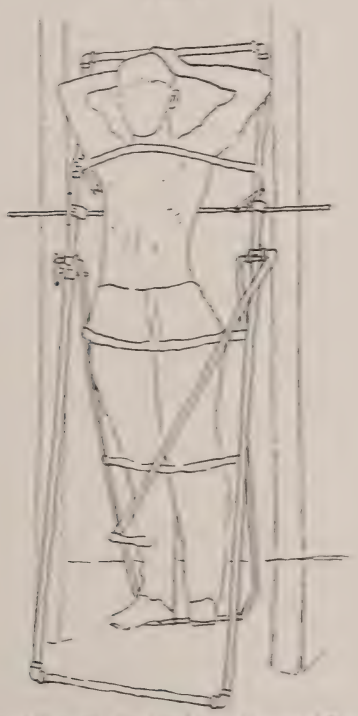
Cases needing measures for the improvement in carriage recorded by measure and photograph, to be kept under observation.

A consideration of the first two would require space beyond the limits of this paper, and is deferred. In the treatment of the cases coming under his care, the surgeon will find the greatest difficulty in his attempts to increase the flexibility of the spine, as the development of muscles is a matter comparatively well understood: while giving elasticity to muscular fasciæ and shortened ligaments, especially in a localized portion of the

spine, presents great difficulty. Precision of application is necessary, and if to this is added the question of simplicity and inexpensiveness, the difficulty is not diminished.

The following measures have, at least, the merits of the latter qualities, and if painstaking work is added a reasonable amount of effectiveness results. The armamentarium consists of a few

FIG. 1.



Rocking apparatus adjusted for backward stretching correction of round shoulders. A leather abdominal band is applied to prevent lordosis. Apparatus can be arranged for diagonal pressure in scoliosis.

wooden blocks, a few straps with buckles, a large strong gas-pipe frame, a few cast-steel rods with adjusting clamps, and a cast-steel rod bent so as to form a swing moved by an adjustable handle. They can all be made by a blacksmith and a gas-fitter at the cost of a few dollars. Cases vary as to the amount of force which can be exerted, and it will be thought best in

most cases to begin with the mildest measures. This is furnished in the following way:

An inch metal rod two feet long is placed across two blocks of wood two inches high, put upon the floor, separated from each other by a distance of eighteen inches, and arranged with staples, which prevent the rod from rolling. A felt pad or pillow is placed over the rod and the patient lies upon this in such a way that the rod presses upon the projecting portion of the curvature. In the simplest form, viz., round shoulders, the patient lies with the rod stretched across the back at the level of the middle of the scapulæ. The attendant exerts greater pressure on the upper part of the sternum and on the lower part of the thorax, or the patient raises his straightened arms, weighted or not with a dumb-bell, letting them fall to the floor above the head, arching the spine backward. Arching of the lumbar spines is minimized by directing the patient to draw up the knees and by exerting pressure upon the lower ribs and the pelvis by means of a strap.

In scoliosis it is necessary to exert a diagonal pressure, and this is effected by placing the patient more upon the side and adjusting the counter-pressure correspondingly. It is almost unnecessary to add that care is needed to prevent the pressure from becoming too much a side pressure, and that it is properly localized. This, however, is a matter easily regulated, the adjustment being simple. This exercise is either active or passive, according to the strength or docility of the patient. It can be made of greater or less efficiency by increasing the height of the blocks on which the rods lie, which diminishes the comfort and increases the strenuousness of the exercise.

Another simple form of flexibility exercise can be furnished in the following way: The patient stands or sits on a stool, leaning his back against the padded top of a gas-pipe frame, the lower portion of which rests in the corner formed by the wall and the floor of the room. The height of the frame upon the patient's back is regulated by the distance from the wall the patient sits or stands. If the patient swings his arms above and back of his head a backward strain is given in the portion of the spine above the point of pressure. This is increased if the patient holds any weight in his hands or pulls upon a Whitely

or weight-and-pulley exerciser. Hollowing the back below the point of pressure is checked by pressure upon the lower part of the thorax and pelvis. The exercise can be made a passive one, if necessary, the attendant manipulating the correction by manual pressure or by means of straps. The direction and adjustment of the correcting pressure requires care in this as in the preceding exercise.

As is well known, simple correcting force can be given by the paddle—*i. e.*, lever pressure—and the use of circingle straps adjusted with cord and pulleys, so as to pull in the proper direction. In the former it is necessary to employ special care that

FIG. 2.

FIG. 3.

FIG. 2.—Natural attitude before stretching treatment.

FIG. 3.—Natural attitude after three months' stretching treatment. Upper backward flexion increased from twenty-six degrees to fifty degrees.

the points of counter-pressure are carefully adjusted, and in the latter the encircling straps need to be kept apart by means of spreaders on one side to prevent undue compression of the chest.

Simple arrangements for correction of the rotation of the spine are not easily furnished. The Hoffa-Weigel apparatus, or its recumbent analogue, or, still better, the various Schultze apparatus, are most efficient in this direction. The only objection that can be presented is that they are essentially apparatus for an institution or a large establishment, and that they are beyond the use of the ordinary practitioner.

The following arrangement, devised by A. M. Greenwood, of the Harvard Medical School, will be found to be of use, though requiring care in application. The patient sits on a stool with a strap fixture on the pelvis, the legs are extended and placed upon another stool, and secured at such an angle with the cross axis of the pelvis as may be desired; the head is slung to diminish the superimposed weight. A milkmaid shoulder-yoke made of steel rods is secured to the shoulders and upper thorax, giving the possibility of a twist to this segment of the thorax as may be desired. In the rotated middle segment a modified logger's

Fig. 4. Fig. 5.

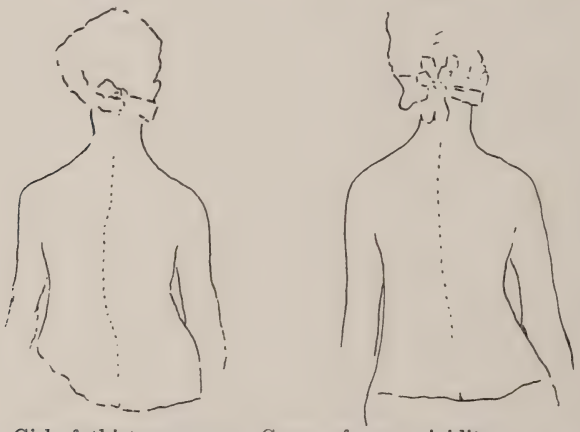


Fig. 4.—Girl of thirteen years. Curve of some rigidity.
Fig. 5.—After four months' home treatment. Increase of daily home gymnastic work from 487 to 1784 pounds.

cant hook can be applied, arranged so as to exert pressure to the front and back of the thorax. This pressure is regulated by a screw, and gives the surgeon a grasp, by which the thorax can be twisted with any desired force. The apparatus requires care in adjustment, but can be made effective. A simpler way can be given by the application of two strips of adhesive plaster around the thorax. If cords are attached to the free ends, which should just clear the points of pressure, any desired amount of pull can be furnished.

Anyone who has read Schulthess' admirable work on *Lateral*

Curvature must have been impressed by the admirable utilization of mechanical force he employs. It is important to see if the same method cannot be employed in a less expensive way. It seems as if it is possible in the following way:

A large gas-pipe frame is made and furnished with adjustable sockets. Playing in a pair of these is a cast-steel swing bent so as to furnish a foot-piece, and at the top at one end, so as to fit into a long handle, which will enable the swing to be moved at will or with weights as a pendulum. A small cross-rod placed in sockets adjustable by screw pressure at any desired height on the frame regulates the point of back pressure, and straps secure the patient to this and to the swing in any desired position. Any desired amount of correcting force can be given. The frame can be made to rest in a doorway, secured by a cord and staples. To arrange for different sizes in patients an extra swing will be needed, but a fine adjustment is arranged by a cross-rod.

If this swing is reversed and lowered it can be applied to the back of the seated patient, secured by proper pressure straps, and made to serve as a trunk-bending appliance with pendulum force.

It is believed that a serviceable amount of correcting force can be furnished in the manner described, which, when applied with painstaking thoroughness, will give good results in increasing the flexibility in suitable cases, and, moreover, this is at the disposal of every surgeon who has the patience and time to devote to a given case.

For measures of muscular development, dumb-bells can be made to answer every requirement under proper guidance. The use of heavy exercises with the addition of heavy bars is of the greatest assistance, as has been shown by Teschner and Erich.

This and a description of the portable appliances needed in many cases to prevent faulty attitudes are subjects left for another paper. The object of the present paper is to call attention to the need of correction in cases of lateral curvature amenable to treatment by such means as can be carried out by the patients for a long period under the direction of a nurse.

As the disease is one of faulty growth, treatment should be carried out during the rapidly growing period. Home treatment under careful directions and simple measures are, therefore, more practicable and beneficial to a larger number of patients than institution treatment.

While it is evident that more thorough treatment can be given in institutions with patients directly under the care of a physician, yet it is also evident that in correcting a process of growth during the growing years, treatment must be carried out for a long period, and success cannot be attained unless home treatment be provided for at the later stages.

Treatment in institutions and by specialists is frequently necessary at certain stages, but, unless it is supplemented by carefully directed home treatment, satisfactory results are not secured.

It is believed that this is practicable in a large number of cases.

SHOE DEFORMITIES.

By E. H. BRADFORD, M.D.,
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The deformities of the human foot are either congenital, like club-foot; those resulting from disease (viz., the distortion following paralysis or osteitis); those following injury, or those caused by footwear. The latter class has not always been clearly understood, as some of the distortions so caused are frequently considered the result of disease or heredity. Hallux valgus or out-toe, and the irritation exostoses of the head of the first metatarsal are often considered to be rheumatic, while the crumpled or hammer-toe is frequently regarded as an inheritance.

A better understanding of the deformities due to shoes can be had after a comparison of the normal shapes and flexibility of the feet, as seen in the feet of babies and of shoeless races, with the conditions universally seen with shoe-wearing people, and by an examination of the construction of boots and shoes as usually worn.

To meet fully the demands on the foot incident to human activity in walking, running, jumping, climbing, freedom of action is needed, not only in the larger joints of the lower extremity, but also in the small articulations of the foot itself, the importance of which is frequently overlooked.

In the normal untrammelled foot there is a pliability comparable with that seen in the hand, viz., a free flexion and extension of toes, a spreading of the front of the foot (especially of the first metatarsus at the metatarsocuneiform articulation) as weight falls upon the front of the foot, a side motion or rotation at the mid-tarsal articulation, needed in walking or running upon an uneven surface.

This freedom of action and pliability in the foot are interfered with by the stiffness of heavy shoes and the pressure of footwear not made to fit the varying size and shape of the foot, but to the conventional shape of a last.

An examination of an adult where shoes have been worn since infancy shows usually many variations from the normal standard. There is almost invariably an impairment in the

Fig. 1.

Hallux valgus, or out toe.

motion of the metatarsophalangeal joints, especially the first. There is usually also a loss or impairment of movement in the first metatarsocuneiform articulation, or the limitation of the power of voluntary spread and arching of the foot. In addition to this there is a relative muscular weakness of the muscles of the sole of the foot, including those attached to the first metatarsal (corresponding to the volar muscles of the thumb), and,

in consequence, after the development of the weak and flat foot there is lack of strength in the movement of the toes.

Misplaced position of the heads of the metatarsals in relation

FIG. 2.

X-ray of hallux valgus, showing how the shoe causes a deformity.

to the transverse axis of the front of the foot often results from boots that are thin and narrow in the waist and narrow in the shank.

A distorted position of the smaller toes, either confined to one toe or affecting many similarly, not uncommon in shoes which check the natural spread of the front of the foot. The first phalanx is short flexed dorsally upon the metatarsus, while the second and third are contracted in a position of plantar flexion.

A loss or impairment of mobility in the metatarsophalangeal articulation is caused by a stiffness of the sole of the boot, which prevents the plantar flexion of the toes bound down to the stiff soles by a strong and closely fitting upper and by the upward rock of the front of the sole, pressing the toes upward, holding them firmly in a position of slight dorsal flexion. This immobility of the toes causes in time a loss of muscular strength in the flexor muscles of the phalanges, and under certain circumstances a loss of elasticity of the capsular ligaments of the toe-joints, so that instead of a flexibility, which should be as great as that of the fingers, the arc of the motion at the metatarsophalangeal joints is limited to a few degrees.

The amount of damage to the strength and ease in walking inflicted in this way is greater than is supposed, and can only be estimated by a comparison of the walking efficiency of shoeless and shoe-wearing races.

The most conspicuous illustration of the superiority of the barefoot races in this respect was afforded in the campaign in Abyssinia. The marked superiority in agility and fleetness of the barefooted Abyssinian was evident. This has also been seen wherever the shoeless are matched against shoe-wearing people in marching. Many of the United States officers have found moccasins and the training necessary to wear moccasins with comfort a help in the pursuit of hill Indians.[1]

The plantar flexion of the toes is an action needed in the

[1] The superiority of the barefooted over the shoe-wearing races in strength and fleetness of foot has been shown in other races besides the Abyssinian.

The Batwa pigmies of South Africa (Atlantic Monthly, August, 1902) frequently journey fifty miles a day.

The jinrikisha men in Japan are said to be able to travel ten hours a day at the rate of five miles an hour.

The best record in forced marching was made by Peruvians, presumably barefooted or sandal-wearing.

backward push of the front of the foot at the end of the stride; the strength of this effort depends on the muscular strength of the muscles governing this motion as well as the freedom of this motion.

Where, as is usually the case among shoe-wearing people, this action is not as strong as among the barefooted, a greater

FIG. 3.

Crowding of the little toe, caused by shoe or sandal strap.

amount of work in the backward push of the foot comes at the ankle-joint, the calf muscles become developed, and the muscles in the soles of the feet are small, and it is commonly seen among barefooted people not subjected to great demands in the way

of climbing or hill work that their feet muscles are large and their calf muscles small, the reverse being true of shoe-wearing people. The normal condition is well seen in the Japanese jinrikisha runners, who have well muscled legs and feet.

This disability, due to an impairment of the strength and freedom of motion of the metatarsophalangeal articulation, is

Fig. 4.

Shoes causing hallux valgus, crowded little toes, and weakened toes.

increased if the great toe is distorted from its normal position in the line of the axis of the foot and is turned outward, presenting the common deformity known as out-toe. Boots and shoes are usually made with their narrowest part at the toes, while the foot is broadest at the toes; the spreading strain of

the boot is greater at the middle than at the toe end of the boot, and it becomes looser there. The result follows that the great toe is subjected as it is pushed forward in the boot at each step to a certain amount of lateral pressure at the toes, crowding the end of the great and little toes toward the middle line of the foot. Where this pressure is great or the resisting power of the articulative ligaments small, a disabling deformity of considerable importance results. In a slight degree the deformity is common among people wearing ordinary and not ploughman's shoes. The deformity is almost universal, so that in anatomical works and in modern art it is frequently presented as representing the normal shape.

No less common than this deformity is the loss or limitation of the power of side motion at the metatarsocuneiform articulation. If the skeleton of a foot is examined it will be seen that considerable side movement is provided for in the metacarpocuneiform articulation of the first metacarpus, and for the metacarpocuboid articulation muscles of considerable strength are furnished for the first of these movements, which is comparable, though in a limited degree, to the movements of the thumb. Mobility in the articulation exists in infants and in all barefooted people, and is developed by training to be of practical use to those born without arms, and in persons with occupations requiring the free use of the foot. In all persons this motion is of value in giving firmness of foot and in enabling people to stand with greater stability on one foot. In all adults wearing modern shoes voluntary movement of this articulation is either wanting or rudimentary, diminishing considerably the strength of foot, and making possible the common accident familiarly known as "turning the ankle." The ankle is more liable to strains the less there remains of the power of spread and grasp in the front of the foot.

How boots and shoes injure the power of motion in this part of the foot can be readily seen. In the ordinary vocations of civilized life there is little need of spreading of the front of the foot beyond the slight amount allowed possible in ordinary boots and shoes. Boots and shoes providing for an unusual spread of the foot, such as would be necessary in climbing and

tramping, would not be marketable. Individuals who rarely walk on anything but a smoothly paved sidewalk can wear without discomfort a snugly fitting boot, which would be extremely uncomfortable in a rough cross-country tramp. The snugly fitting boot comfortably fitted to the foot in its least spread shape would exert a distorting pressure whenever the foot is spread by an occasional unusual step, besides exerting a cramping and atrophying influence on the muscles of the foot.

FIG. 5.

Shoe causing dorsal pressure, by reason of the inelasticity of the upper.

An evening glove, comfortable or even loose in ordinary wear, will be found too small if worn when driving a hard-bitted horse, in bicycling or golfing, and if worn would weaken the grasp of the hand.

When the front of the boot fits very closely plantar flexion of the toes is impossible, and if the sole is stiff and rolled slightly upward at the front the toes are held in a slightly raised position. If the boot is also closely fitted at the sides the first metatarsal is crowded toward the centre of the foot, and not only is inward motion at the metatarsophalangeal articulation impossible, but any up-and-down play at the joint is checked. Weight at the end of the step cannot fall freely on the head of the first metatarsal at the end of the step, as it should nor-

mally, but comes chiefly on the head of the second, third, and fourth metatarsals. What is termed flattening of the transverse arch results. This can be easily recognized by the callosities on the sole of the foot, which are under the middle of the forefront of the foot, instead of under the head of the first metatarsal. Where high heels are worn on pointed snugly fitting shoes this distortion is inevitable if the individual is active as a walker.

FIG. 6.

Drawing up of the toes, caused by pressure of the shoe on the dorsum of the foot.

The disadvantages of the flattening of the transverse arch have been already well described, and are well known both in the neuralgic form of pinched nerves, or in the milder form of strained and aching ligaments. The impairment in walking ability is evident; the great toe is put out of commission almost as much as in hallux valgus. The finish of the step comes upon the foot and not upon the toe, as it normally should.

Where the shoe is not pointed but broad at the toes, if the upper is cut so as to give but little room over the heads of the metatarsals or the toes, and is inelastic, with but little flexibility of the sole, flexion of the toes is interfered with and the power of strong plantar flexion is lost from weakness of muscles.

There is inevitably a slipping of the foot forward in the shoe in walking or running. As shoes are ordinarily constructed the toe portion is the narrowest part of the boot, while, as the foot is made, the line across the toe is the broadest of the cross lines across the foot. More or less crumpling of the toes results. The amount of this depends upon the resistance offered by the muscles and ligaments of the foot and the degree of the distorting character of the shoe. The form of the distortion varies with the degree. The toes either become flexed, or, having been crowded, one lying over or under the other,

Fig. 7.

A shoe arranged so as not to cause as much pressure on the dorsum, and preventing the distortion.

remain permanently so. The inward crowding of the little toe and the crumpling of it is almost universal, even among sandal- or slipper-wearing people, providing the sandal is provided with a cross toe-strap, as is the case with the Greek and some of the Oriental sandals.

The amount of disability caused by these shoe deformities varies necessarily with the deformity, its extent, and the weight of the individual, as well as the use the foot is given.

In the attempt to support the weakened arch of the foot

shoes are usually made arching up under the cuneiform and metatarsals, rather than the head of the astragalus and scaphoid, which especially need support in weak feet. This supposed arch support becomes in reality a binding of the waist of the foot, which atrophies the muscles of the sole, and, as these muscles are plantar flexors of the toes, the power of flexion of the toes—the downward push needed in walking—is lessened. The individuals become heel-walkers, or use the ball of the foot more than the toes for the final propelling force. This weakening of the muscles of the sole of the foot is aided in deforming the foot by the pressure of the upper of a thin-waisted shoe upon the dorsum. This, by its irritation, especially by the cross seam in the upper, causes a contraction, drawing up the toes, which, if extensive, makes the toes comparatively useless as factors in gait. This is helped by the shape of the shoe rocking up to the front, which checks by its shape the normal plantar flexion of the toes.

That there is an earnest effort among shoe dealers to check the deformity of the feet by shoes is evident in the shapes of shoes, especially for men, offered for sale. It is evident, however, that the purchasing public should be thoroughly informed of the needs in shoe wear, and that the need of improvement is urgent is shown in the great prevalence of foot deformity. Even gymnasium workers cramp the feet in a way which prevents the development of the most used muscles of the body.

A boot is not made in the shape of the foot but on a last. The last-maker caricatures the normal shape of the foot as the fashion-plate artist caricatures the figure. This is to an extent necessary in the art of boot-making, for, as the foot varies in size and compressibility according to the strain put upon it the last represents the compromise. A boot which would be comfortable to an individual climbing a mountain would be loose for the same individual in his arm-chair, and therefore unsalable to those whose time is passed principally in muscular ease. The compromise is a conventional type. The boot-maker and the boot-buyer often overlook the fact that there is need of avoiding pressure of certain parts of the boot, not because this causes pain to the foot, as the front of the foot can be com-

FIG. 8.

Fashionable shoes for women which interfere with the circulation and weaken the muscles from constriction.

FIG. 9.

Fashionable shoes for women which interfere with the circulation and weaken the muscles from constriction.

pressed without discomfort, but because distortions are favored by pressure on certain parts of the foot. These distortions develop gradually, and in old age, where all possible suppleness is to be preserved, deformities are caused.

Boots and shoes made ready for sale are fashioned according to shapes which are in popular demand. The statement of a shoe dealer expresses the fact: "A shoe is sold almost entirely on style."

FIG. 10.

Deformity caused by the constriction and confinement of the foot.

Style being a varying quantity, the shape of the shoes varies, often with exaggeration, as seen in the absurdly square-toed shoes of the period of the thirty years' war and the "toothpick" shoes of a decade ago. The exaggeration gives the advertising note, the "cri d'affiche," which attracts the buyer. This may be harmless, like the exaggerated curve on the outer side of the boot or in the unnecessary projection of the sole beyond the borders of the foot. But the tendency of fashion will always be toward shoes of the leisurely rather than the working people.

The boot for the ploughman will not be popular among patrons of the Pullman car. A boot fitting the natural shape of an infant's foot and broadest at the toes will never be generally used, and shoe constriction of the foot will be common, in the desire to avoid the appearance of a clodhopper. But it is desirable that this constriction shall be as small as is practicable. The fitting of a new shoe on a weak-ankled child, with the necessary poundings on the sole and pullings on the upper, illustrates an amount of injurious and unnecessary compression of some portion of a boot, which is to be avoided in a child.

In protecting his feet a man of fashion need not avoid fashionable boots. If he becomes a man of activity he needs boots which suit his occupation and are not suited to a ball-room—just as he would not drive a four-in-hand with evening gloves.

A lady of leisure, if as leisurely as an odalisque, can wear such footwear as she wishes; but if she plays golf or tennis, or walks actively in shopping, she should wear shoes which will not bind her feet, or she will suffer by deforming or weakening them.

A growing child is necessarily active and needs shoes which never constrict, and every intelligent effort should be directed to supplying children with shoes which are nearer to the moccasin or sandal than to the fashionable boot of adults, and which not only fit the natural shape of the foot, but spread to the utmost extent. The mistake of tightly binding a child's ankles has been well spoken of by the President of our Association, Dr. A. Wilson: "The natural human foot best performs its functions when it has been free from restraint. The natural foot can be quickly crippled into inefficiency by high counters, corset shoes, arch raisers, wedges, and elastic anklets. The natural foot when burdened by misapplied mechanics is rendered weak, and therefore susceptible of sustaining injury, such as sprains and the formation of bunions, flat-foot, wabble joints, etc." Low shoes are naturally preferable for children, as they avoid the constriction of the ankle, which weakens. A boy training as a baseball pitcher does not bind his forearm, a girl pianist does not lace her wrist, and in the same way binding the ankle, perhaps necessary in rough walking, is injurious if constant.

For active exercise the front of the foot should not be compressed. Boots and shoes should be straight on the inner edge, should be sufficiently long, should not rock at the top, and should give sufficient play to the toes. Boots should not bind the lower instep (that is, in front of the mediotarsal articulation), but should allow a certain amount of spread to the front of the foot as the weight falls upon it.

Fig. 11.

Photograph of a shoe-wearing white man and a barefooted native taken in the Solomon Islands, showing the sole muscles of the white man and the strong sole muscles of the native, the free action of the toes, and the arch of the foot.

Children need shoes which slip on easily, which are as unconstricting as the boot of a ploughboy, if their parents wish them to avoid the weakening of the muscles of the foot, which furnishes a condition in which distortions may develop. Children should not be robbed of their birthright of strength.

Shoe deformities furnish a subject of practical importance to the surgeon of to-day. It is to be hoped, however, that as in savage communities they are unknown, the surgical writer in the next generation will refer to them as curiosities, the unnecessary disabilities of an unthinking period.

Shoe deformities will be prevented when the shoe-wearing

public has been taught that the boot should suit the use of the foot. No one drives in evening gloves, but in gloves suitable in shape to a firmly grasping hand. In leisure an adult can wear as fashionable shoes as he wishes, but no one should walk actively in dress boots or boots shaped like them. If he does, his foot suffers. He should wear boots allowing a free spread to the front of the foot.

A normal young child is always active in its waking hours and should never wear shoes cramping the feet, which should be as free as those of an Indian tracking game.

A NEW METHOD OF TREATMENT FOR FRACTURE OF THE NECK OF THE FEMUR, TOGETHER WITH REMARKS ON COXA VARA.

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My especial interest in fracture of the neck of the femur has been in the accident as it is seen in childhood. In previous papers I have endeavored, first, to establish the fact that it is not at all uncommon; second, to point out certain distinctions between the immediate and remote results of the injury in childhood and adult age; and third, to suggest treatment by which the disability might be remedied.

This treatment was directed more particularly to the resulting deformity than to the immediate injury, for in none of the cases reported was the patient seen by me until several weeks or months after the accident. In all the cases, nineteen in number, with but one exception, there was union, an average shortening of not more than three-quarters of an inch, and but little disability other than a slight restriction of motion, a moderate limp, and a certain discomfort during the stage of repair.

The rapid recovery from the injury indicates that in childhood the neck of the femur is forcibly depressed without complete separation at the point of fracture. The average result, therefore, in spite of non-treatment, is far better than that ordinarily attained in adult age. Yet the result is far from satisfactory, for depression of the neck of the femur, whether traumatic or otherwise, sufficient to cause even half an inch of shortening, predisposes strongly to further depression, consequently to a gradual increase of disability similar to that caused by coxa vara of the ordinary type.

For this reason I have suggested the advisability of breaking up the so-called impaction, with the aim of reducing the deformity should an opportunity present itself; in other words, to treat this fracture as one would treat a green-stick fracture of the shaft of a long bone.

It is apparent that one cannot apply direct force for this purpose in this situation, but the desired result may be accomplished in another manner. The range of normal abduction of the thigh is dependent upon the upward projection of the neck of the femur, which normally forms an angle with the shaft of from one hundred and twenty-five to one hundred and forty degrees. The extreme limit of passive abduction is reached when the neck and trochanter come into direct contact with the rim of the acetabulum. If the angle between the neck and shaft of the femur is lessened, the range of abduction is correspondingly restricted. As this limitation of abduction is a constant symptom of depression of the neck of the femur, restoration of the normal range would imply correction of deformity if the capsular ligament were normally resistant. Forcible abduction of the thigh is indicated, therefore, as a means of replacing the depressed neck of the femur. In this manœuvre one uses the rim of the acetabulum as a fulcrum, the shaft as a lever, and depends upon the lower border of the capsular ligament to fix the head of the femur. When the normal limit of abduction as compared with that of the other limb is reached, one may infer that the deformity has been reduced; for the weakened neck should give way before the capsule becomes sufficiently stretched to allow a subluxation of the head. If, then, the limb be fixed in this attitude of extreme abduction, repair should take place in an approximately normal position, even if the fracture were made complete by the manipulation.

Recently I have had the first opportunity to test this treatment. A boy eight years of age was brought to me by his family physician on October 30, 1901. Three weeks before he had fallen from a fire-escape to the pavement, a distance of about fifteen feet, sustaining bruises about the left hip, the resulting symptoms of discomfort, weakness, and local sensitiveness

being aggravated by his attempts to walk. On examination, shortening of half an inch was found in the length of the limb; the left trochanter was prominent and elevated; motion was somewhat painful, and was limited by voluntary and involuntary contraction of the muscles. This limitation was most marked in the direction of abduction.

The child was anæsthetized, and it was then found that the movements of the joint were practically unrestricted except in abduction, which was limited to about half the normal range. The thigh was slowly and forcibly abducted, in the manner described, to the normal limit as compared with its fellow, and the limb was fixed in the attitude of complete abduction by a long plaster spica bandage. Some weeks later this was replaced by a short Lorenz bandage in an attitude of lessened abduction. At this time the limbs were of equal length; the trochanter was in normal relation to Nélaton's line, and the abnormal projection had disappeared.

It may be of interest to note that the child had been walking about practically from the beginning of treatment, the mother stating that it was impossible to keep him quiet after the discomfort had been relieved. On February 26, 1902, or about four months after the accident, all restraint was removed. There were at this time no physical signs of the accident, and a Röntgen picture showed restoration of the normal angle of the neck. The functional result is perfect.[1]

I am convinced that the treatment adopted in this case, that is to fix the limb at the limit of normal abduction, under anæs-

[1] Since this paper was written the method has been applied in a second case. The patient, a girl, six years of age, was brought to the Hospital for Ruptured and Crippled on August 21st of the present year. Three weeks before this she had fallen from a second-story window, injuring her left hip. For three weeks she was practically confined to bed, and as the limp and discomfort persisted it became evident that the injury was more serious than had been supposed. The symptoms and physical signs were identical with those of the preceding case, as was the treatment. After the limb had been forced to the limit of abduction it was replaced in the normal attitude for comparison with its fellow. The abnormal projection of the trochanter had disappeared and the limbs were of equal length, a convincing demonstration of the fact that the deformity had been reduced. The final result (November 13th) is perfect.

thesia, by means of a plaster spica bandage, might be applied to patients of adult age with advantage, and that it offers a prospect of a far better ultimate result than that usually attained by the ordinary methods of treatment.

In the cases of this class that I have had the opportunity to examine, excluding those in which no serious attempts to secure union had been made, there is, as a final result, almost always shortening, marked limitation of abduction, and in many instances fixed adduction of the limb with corresponding functional disability and its attendant discomforts. The disability is aggravated, doubtless, in certain instances by premature use of the weakened part, but it is caused primarily by a deformity that has never been reduced, or that, if reduced, has again recurred. The museum specimens show also, in many instances, either non-union or exuberant callus formation that must have interfered very decidedly with function. Such results indicate failure in the apposition and fixation of the fragments.

I need not review the familiar methods of treatment of this injury. It is sufficient to say that if the aim is reposition and subsequent retention in normal position, they are faulty in conception and in practice. If, however, the patient were anæsthetized, and if, under traction and countertraction, the thigh were abducted, it would seem that the outer fragment, which would be turned downward and inward, would be far more likely to be brought into apposition with the inner fragment than when the limb is held in the line of the body. If reposition were attained, it could be assured by the long plaster spica bandage, for this would provide the antero-posterior support that is lacking in the ordinary splints; while upward displacement, supposedly caused by muscular action, would be prevented by the direct contact of the outer extremity of the neck and the trochanter with the rim of the acetabulum and side of the pelvis.

The plaster bandage is said to be uncomfortable and inefficient, but from my own experience with it, both in the treatment of children and of adults, I am inclined to think that the discomfort is due rather to its improper application and to the neglect of subsequent supervision than to any inherent defect of the method.

The only appliance that compares with it in efficiency of support is the Thomas hip-brace; but this is equally difficult of adjustment, and it does not permit the attitude of abduction, which is the point of special interest in this connection.

I again take the opportunity to call attention to the statement in the text-books of general surgery that fracture of the neck of the femur is extremely uncommon, except in old age, a statement manifestly misleading and untrue. In addition to twenty cases of fracture of the neck of the femur in childhood and adolescence that I report, I have seen during the past year five cases in early adult life (twenty-eight to forty-five years). One patient had been examined by an ambulance surgeon and assured that he was simply bruised. One was discharged after a stay of two days in a hospital, with the same assurance. Two patients had been treated in a hospital for fractures at the ankle, the injury of the neck of the femur having escaped notice. In the last case no diagnosis had been made. In all these cases the fracture was undoubtedly impacted, and it would seem that in this class, as in childhood, the fracture is often incomplete.

It would appear from my own experience that it is a correct diagnosis rather than the fracture that is uncommon, and I should suggest the importance of careful measurement in all cases of injury about the hip, for if one found actual shortening of the limb, he could scarcely overlook the confirmatory signs of fracture.

As regards the treatment of impacted fracture, I may state that under favorable conditions I should not hesitate to attempt to reduce the deformity in the manner already described, a procedure which is a radical departure from traditional methods.[1]

[1] I am now able to report a case in which the method has been applied. A woman, twenty-eight years of age, was referred to me on January 29, 1902. Five weeks before this she had fallen in the street, injuring the right hip. She was assisted to her home, and had since remained in bed. On examination the limb was found to be flexed and adducted. Motion was painful, and it was restricted by involuntary spasm of the muscles. Under anæsthesia the distortion was overcome, but it was impossible to force the thigh to the limit of normal abduction, apparently because repair had advanced too far. A Lorenz spica bandage was applied, and four weeks later the patient was allowed to go about on crutches. At the present time (November, 1902) she walks with but slight limp, there is but one-half inch of shortening, and practically no restriction of motion

Fixation in the attitude of abduction has been considered thus far with special reference to the fracture itself, but it should be of service also in preventing the additional limitation of the range of abduction, caused by accommodative shortening of the muscles during the period of fixation.

There is another point in the treatment of fracture of the neck of the femur that deserves consideration. This is the desirability of protection of the weakened part for a time after ambulation is resumed. For it is probable that functional use before repair is complete may increase the deformity and aggravate, it may be, the so-called rheumatoid changes that are sometimes observed after fracture. For this reason I have employed, in the after-treatment of some of these disabled patients, the ordinary hip-splint as a traction appliance in the more painful cases, or as a simple perineal crutch when complete or partial removal of the strain was indicated. This appliance relieves the discomfort and enables the patient to walk about without the aid of crutches. It is, perhaps, needless to insist upon the importance of massage and of forcible manipulation for the purpose of resisting the tendency toward adduction of the limb as an adjunct to mechanical treatment whenever it is practicable.

I have placed what may be considered the more practical part of this paper in a section by itself. There are, however, other points of interest that are involved in a consideration of disability due to deformity of the upper extremity of the femur. For example, the exact location of the injury of the neck of the femur in childhood is of importance, at least from the standpoint of prognosis. I have always contended that when subjected to direct violence the neck of the femur should break at its weakest part, or about its centre, rather than at the epiphyseal junction, for this is the thickest part of the bone, and it is protected by a strong rim of cartilage, which is far more elastic than the bone. Moreover, that free motion at the hip-joint, except in abduction, when there is three-quarters of an inch shortening of the limb, as in the majority of the cases that I have reported, is an almost positive indication that the injury does not involve the articulating surface of the head of the bone. For if there were true epiphyseal separation to the extent that

would explain this shortening the irregularity within the joint would cause far more serious functional derangement. This contention has been supported, now that the X-ray is available for diagnosis and by several anatomical specimens as well. I may state again, therefore, that, in all but very exceptional cases, in childhood the neck of the femur will give way at some distance from the epiphyseal junction. In adolescence, however, the newly formed bone about the epiphyseal cartilage is apparently a weak point. This is indicated by the fact that the deformity of coxa vara of the adolescent type is often most marked at this point. Such cases of coxa vara in which the disability is suddenly increased by a fall, or even by a slight injury, may be mistaken of true primary epiphyseal separation, and several cases have been reported as such. The following case is an example of this class.

A boy, aged fourteen years, of large size, who had for several years used a crutch because of amputation of the thigh, was brought to me on January 2, 1902. Eight weeks before this time he had slipped and injured the right hip. Immediately after the fall he was placed in bed, and remained there for two weeks, suffering somewhat from discomfort and stiffness in the joint. For about six weeks he had been about on crutches. There were marked flexion and adduction of the thigh and almost complete limitation of motion in all directions. A diagnosis of partial epiphyseal separation was confirmed by an X-ray picture. On careful questioning it then became evident from a history of increasing discomfort and stiffness in the hip-joint for several months before the accident that the injury had simply hastened the progress of coxa vara of the epiphyseal type.[1]

This case is identical with two reported by Sprengel in youths aged respectively seventeen and eighteen years, in which epiphyseal displacement followed slight injury. In both cases discomfort and a certain degree of disability had preceded the accidents for an indefinite time. Such cases should not be classed

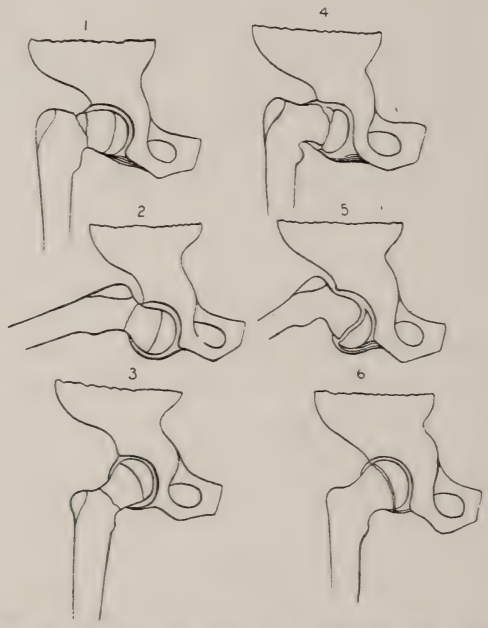
[1] This patient was treated by the method of forcible abduction, with a satisfactory result.

as examples of epiphyseal separation in normal subjects, nor are they of particular importance in their bearing on the question of the relative frequency of fracture and epiphyseal separation in childhood, as is assumed by Sprengel and by others. (*Archiv für klinische Chirurgie*, 1898, Band xlvii., S. 805.) That true epiphyseal separation may occur is, of course, admitted. The following case that I have already reported is an example.

A boy, aged sixteen years, came to the Hospital for Ruptured and Crippled on October 10, 1899, walking with the aid of a crutch. Three weeks before while playing football his left thigh was violently abducted. This strain was followed by pain and weakness, which so increased on use of the limb that he required assistance to reach his home. The attitude of the limb was one of slight flexion and outward rotation. There was an inch of shortening with corresponding elevation of the trochanter, and motion was much restricted in all directions. A Röntgen picture showed partial epiphyseal separation. The later history of this case differs from that of fracture of the neck of the femur in that motion of the joint has remained restricted as at the first examination. At the present time there is nearly two inches of actual shortening, which is increased to three inches by adduction of the limb.

I think that it is fair to conclude that, as compared with fracture of the neck of the femur, epiphyseal separation is uncommon; that it is more likely to occur in adolescence than in childhood, and that in certain of the reported cases progressive deformity of coxa vara of the epiphyseal type preceded the injury. True epiphyseal separation should be treated in the manner suggested for ordinary fracture, as abduction of the thigh would be the attitude most likely to approximate the fragments. Excision of the head of the femur as performed in Sprengel's cases can hardly be recommended as a treatment of routine. The immediate result of excision, in the sense of restoration of motion, is favorable; but, as a rule, progressive shortening and deformity follow, because there is in most instances upward displacement of the neck upon the pelvis, with

disability similar to that of dorsal dislocation of the hip. If, therefore, an open operation is performed, one should either attempt to actually replace the head of the bone or to simply cut away the projecting portions that interfere directly with movement. Afterward an osteotomy of the femur may be indicated to restore the normal angle of the neck.



1. Fracture of the neck of the femur. 2. Restoration of the normal angle by forcible abduction. 3. The limb in normal position. Figs. 4, 5, and 6 illustrate separation of the epiphysis of the head of the femur treated by the same method.

The discussion of the immediate rectification of traumatic depression of the neck of the femur offers an opportunity for a further note on the treatment of the deformity when direct replacement is impracticable, as in the ordinary type of coxa vara, traumatic or otherwise. In such cases, after the forcible stretching of the contracted tissues, one should restore the normal angle between the shaft and the neck by removing a sufficient wedge of bone from the base of the trochanter. In this opera-

tion, as I have suggested in former papers, a portion of the cortex at the apex of the wedge on the inner side of the femur, opposite the trochanter minor, should be preserved. The thigh is then gently abducted, and, the trochanter and neck being fixed by direct contact with the upper border of the acetabulum, further abduction closes the wedge-shaped opening. The limb is then retained in this attitude of complete abduction by a plaster spica bandage until union is complete. The short, or preferably the Lorenz, spica will fix the part securely, for, as the continuity of the femur is unbroken, there is no danger of rotation or other displacement of the fragments. Within a few weeks the patient may be allowed to walk upon the limb, for in this attitude of complete abduction the body is so inclined toward the limb that the line of weight is practically that of the neck of the femur, and functional use that does not entail overstrain aids repair.

This operation, performed in the manner described, is better adapted to the treatment of children than for older patients, because in the latter class what might be called retroversion of the neck is usually combined with the depression. In fact, in certain instances this retroversion, which rotates the foot outward and limits the flexion of the thigh, may be of greater importance than the actual depression, as is illustrated in the following case.

A woman, twenty years of age, applied for treatment at the Hospital for Ruptured and Crippled because of a stiffness and discomfort of infinite duration in the right hip. She could not walk a block without extreme fatigue, nor could she sit with comfort because of the difficulty of flexing the thigh. There was slight adduction of the limb, which was so increased by flexion that the patient was obliged to cross it over its fellow when she assumed the sitting posture; there was also outward rotation of the limb and a marked limp. In this case the depression of the neck of the femur was so slight that there was less than half an inch of actual shortening, the physical signs depending in great degree upon its retroversion. On July 11, 1901, after preliminary stretching of the secondary contractions of the

soft parts, the femur was divided below the trochanter minor. The shaft was then rotated inward sufficiently to bring the foot into normal position, and the limb was fixed in an attitude of moderate abduction by a long spica plaster bandage. Eleven weeks after the operation she resumed her work as a servant. At a recent examination the limbs were found to be equal in length, flexion was possible nearly to a right angle, and the patient stated that she could walk a distance of several miles without discomfort.

In cases of this type, and, in fact, in the majority of cases of the adolescent type, simple linear osteotomy is the operation of choice.

Although cases of coxa vara in the progressive stage are sufficiently common, comparatively few of the remote results have been reported. In this connection the following case may be of interest.

A man, aged fifty-two years, was seen in October, 1901. He stated that at the age of sixteen years he had suffered from obscure symptoms of discomfort in the hips and thighs, with gradually increasing disability, until at the age of twenty years, in spite of, or as he thinks because of, the various remedies that were prescribed, he became bed-ridden. He then discontinued all medicine, and thereupon improved rapidly and regained his usual health, although the limitation of motion at the hip-joints persisted, making locomotion somewhat difficult. Within the past year or more he had again begun to suffer discomfort, more particularly in the right hip. Examination showed typical bilateral coxa vara. The patient was unable to separate the thighs more than a few inches, and had always walked with one limb behind the other. Motion was extremely limited in both joints, and apparently there were so-called rheumatoid changes on the right side which were the cause of his more immediate discomfort. It is interesting to note that until this time he had not been informed of the nature of his disability. This case is an illustration of late, although, even after thirty years, not a final result of neglected deformity.

It may be stated that there is no possibility of a spontaneous cure for coxa vara, in the sense of restoration of the normal angle between the shaft and the neck of the femur. During the progressive stage of the affection there is usually local discomfort in the weakened part, and as a result secondary muscular spasm and contraction. When the progress of the deformity is checked by the resistance of the compressed bone, and by relief from strain incident to the enforced inactivity of the patient, repair begins. The muscular spasm disappears, the contracted tissues relax somewhat under use, and an unconscious adaptation lessens the functional disability. This completes the so-called cure.

If a diagnosis of coxa vara is made in the early stage its further progress may be checked, temporarily at least, by appropriate mechanical support. This treatment will relieve the secondary muscular spasm and the direct discomfort in the more advanced cases. It must be continued, however, for an indefinite time, and there is a probability of the recurrence of the symptoms when ordinary use of the limb is again permitted. It is essentially a palliative rather than a curative treatment. For this reason I am in favor of the operative procedures that have been described, whenever they are practicable.

The most favorable cases are, of course, those of the unilateral type in which the depression involves the neck as a whole. In this class perfect functional cure may be expected. The least favorable are the cases of the rapidly progressive bilateral type in which the distortion is most marked in the vicinity of the head of the femur. In cases of this class forcible abduction of the thighs in the manner described may correct in some degree the deformity, and it may be employed as a preliminary measure.

It is well known that knock-knee and bowleg can be cured by immediate over-correction of the deformity, and, as has been stated, simple coxa vara may be as effectively remedied by the same treatment. This statement would hardly require argument were it not that the nature of coxa vara has been obscured by the inferences and speculations of those who have written upon it. Certain writers speak of the deformity as an effect of a "recrudescence of general rickets," others explain it by the assumption of a peculiar local disease that begins without cause

and ends as mysteriously. It is a matter of common observation that in the cases of coxa vara of later childhood and adolescence there is practically never general rachitis, and there is no adequate evidence to support the assumption of local osteomalacia as a cause of the deformity. Certainly, if such a disease were present the distortion would recur after operative treatment, yet in my experience this has never happened.

It is reasonable to assume that in many instances the deformity of coxa vara as seen in adolescence is, like other deformities of this class, simply an exaggeration of a slight pre-existent distortion. This develops in adolescence because this period of rapid growth and instability is a period of weakness, when, too, the burden of laborious occupation is often assumed. Coxa vara to a slight degree is often present in ordinary infantile rachitis, as has been demonstrated by Fiorani, but it is masked by the more evident distortions of the long bones. As it is usually slight in degree, it does not cause of itself noticeable symptoms, although, as has been stated, it is undoubtedly a predisposing cause of more extreme deformity in later life.

In certain of the cases of adolescent coxa vara, particularly of the bilateral form, the patients may present every evidence of general weakness, but even in this class a very much larger proportion suffer from weak feet, or round shoulders, or knock-knees than from coxa vara. This general weakness, incidental to rapid growth, may be exaggerated, of course, by improper food and environment. It is a predisposing cause of any bodily deformity; it should be recognized both in preventive and curative treatment, but it hardly deserves the title of rickets, recrudescent or otherwise.

It is well known that the angle formed by the shaft and neck of the femur is considerably less in the adult than in the child, a gradual depression being incident apparently to growth. In certain instances the femoral necks may be abnormally weak and delicate in structure, or the presence of congenital fissures in the neck, as described by Wolff, may predispose to abnormal depression as the part develops. The effect of injury in actually causing the deformity has been mentioned, and it is probable that the injury as a predisposing cause of coxa vara is a more

important factor in the etiology than has been generally believed. Finally, it may be admitted that there may be instances in which the deformity is caused by the local softening that has been mentioned. It is certain, however, that in most cases the congestion and weakness that have been found at operation are results of progressive deformity rather than cause.[1]

In conclusion, I present a summary of the cases of depression of the neck of the femur that have come under my observation. 20 of these were traumatic (fracture) and 53 were simple coxa vara, a total of 73 cases.

Statistics of Fracture of the Neck of the Femur in Early Life.—Sex, males, 10; females, 10. Age, two to three years, 2; three to six years, 7; six to nine years, 7; sixteen years, 2; eighteen years, 2. Nature of the accidents: one patient fell from the sixth floor of a house; two patients fell from the window of a fourth floor; one patient fell from the window of a third floor; one patient fell from the window of a second floor; six fell from heights averaging fourteen feet; four fell down flights of stairs; one was run over by a cart; one was knocked down by a street-car; one was injured in a game of football; in one case the history is indefinite.

In one case the patient was treated in a hospital, and in this case excision of the head of the femur was performed because of non-union. In one case already described the deformity was rectified soon after its occurrence. The remaining eighteen cases received no treatment for the injury.

Statistics of Coxa Vara. Sex, males, 38; females, 15. Age when the patients applied for treatment: adolescence, twelve to eighteen years, 31; later childhood, five to eleven years, 16; adults, 4. Age when symptoms were first noticed: adolescence, 27; later childhood, 16; childhood, 9; indefinite case, 1. Character of deformity: it was bilateral in 10 cases, unilateral in 43—22 of the right and 21 of the left side. In 3 instances the distortion was apparently forward and downward, in 5 directly downward, and in 45 it was downward and backward.

[1] In this review of the etiology of coxa vara those cases in which the deformity is the result of local or general disease, and is, as it were, incidental, have not been considered.

Many of the cases were observed before the X-ray was available for exact diagnosis, and in other instances this examination was impracticable. It is estimated, however, that in about one-quarter of the cases the deformity was most marked in the vicinity of the head of the femur (epiphyseal coxa vara). This is especially common in those cases that develop rapidly in adolescence. In the remaining three-quarters the entire neck was depressed (cervical coxa vara). In fourteen there was a definite history of infantile rachitis. In many cases no definite conclusion could be reached on this point, and in the larger proportion of the cases there was no history or sign of this affection.

A HEAD SUPPORT FOR CASES OF ROTATORY LATERAL CURVATURE OF THE SPINE SITUATED IN THE UPPER DORSAL REGION.

By REGINALD H. SAYRE, M.D.,
NEW YORK.

One of the points in which almost all writers on rotatory lateral curvature of the spine agree is in the advisability of removing superincumbent weight.

A very large number of those who advocate this theoretically do not practice it; at least the means they suggest for treating these patients during the larger part of each day do not remove superincumbent weight, or do so very imperfectly.

A good many of the older authors and some of the more modern writers have advocated lying down for a large part of the day, with or without traction applied to the head, according as this latter method seemed to the particular author to lessen the rotation or accentuate it.

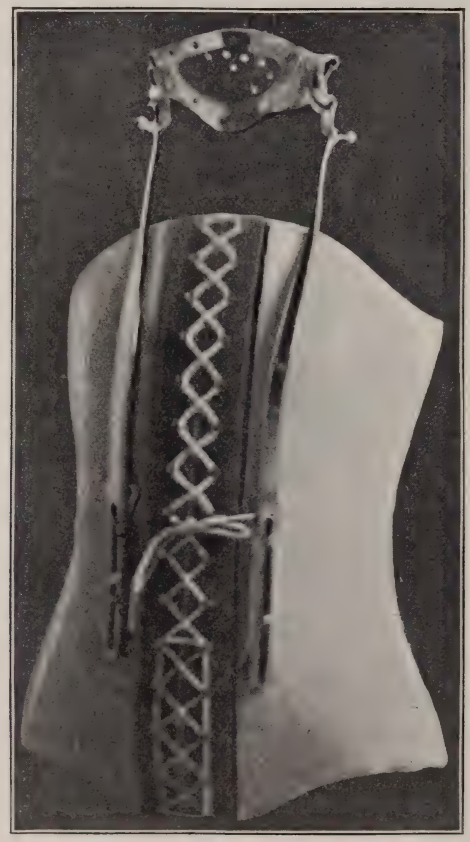
A certain number of cases of lateral curvature, in the author's opinion, require support while in the upright position, as the soft and growing skeleton will otherwise yield and become irremediably distorted.

When the curve is high up in the dorsal region or in the cervico-dorsal spine the use of the ordinary jackets is useless, as they stop at the point where the curvature begins, and if they are used at all should, logically, be supplemented by a head support.

The accompanying photographs show a form of head support that I have found very useful in these cases of high lateral curvature, where the presence of rickets or of paralysis made support an essential in maintaining the position of the growing bones.

A pair of steel rods are fastened to the front of an ordinary plaster-of-Paris jacket; slits in the rods permit their being regulated as to height by loosening the screws which fasten them to steel plates riveted to the jacket. The rods are placed in

Fig. 1.



Corset for lateral curvature, with head support.

the front of the jacket rather than in the rear, both for convenience and strength.

On top of the rods are bent steel wires, which fit into a padded steel head support, and by their elasticity allow the head to nod. As the mouth is opened by dropping the lower jaw, and

not by lifting the upper one, the front part of the head support is hinged to the rear and held in position by a spring which exerts upward pressure, but which is not strong enough to prevent the opening of the mouth whenever desired. The lower part of this front piece is curved to fit the front of the neck, experi-

FIG. 2.

Corset for lateral curvature of the spine, with head support.

ence having shown that this is preferable to having it terminate in a sharp edge whose pressure is often uncomfortable.

The chief advantage this form of head support possesses over the ordinary jury-mast is that it is less conspicuous.

Some may say that in a disease which does not threaten life

parents will object to placing a head support on a child, but the writer's experience has been that parents are very glad to

FIG. 3.

Showing use of head support in lateral curvature of spine involving first, second, and third dorsal vertebræ.

adopt measures that will save their children from a lifelong deformity, and that many of them would rather see the child

dead than deformed. There is no question that these cases of cervico-dorsal curvature are most difficult to keep straight and will become deformed unless support is applied. The only modern writer who seems to have appreciated this is Hoffa, who says: "In order that the deformity of the spinal column may be fully overcome by means of the corset I remove weight at the head by applying to the corset a stretching and supporting apparatus for the head similar to the one used for spondylitis, and already described and illustrated under that head." All of Hoffa's cases of lateral curvature in his book, however, are shown with the ordinary corset, leading one to suppose that in his practice the use of the head support is the exception rather than the rule.

ROUND SHOULDERS AND FAULTY ATTITUDE: A METHOD OF OBSERVATION AND RECORD, WITH CONCLUSIONS AS TO TREATMENT.

By ROBERT W. LOVETT, M.D.,
BOSTON.

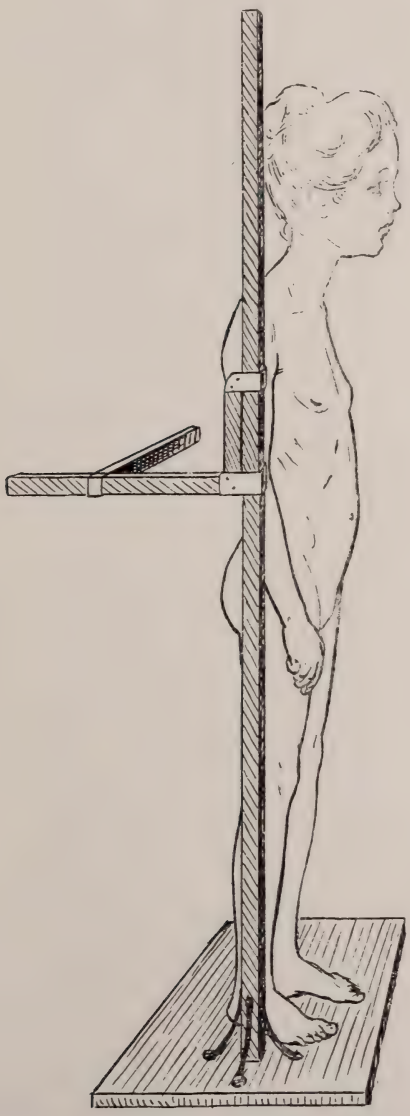
The present paper is intended to call attention to a simple and fairly accurate method of observing and recording faulty attitude in standing. This matter is of importance because the type of faulty attitude known as round shoulders, for instance, is not a local but a general disturbance of the antero-posterior balance, involving pelvis, legs, and feet as well as the spine. As former observations have been concerned mostly with the spinal curve alone, to appreciate the affection properly the base of support must be also considered. This method of record throws a certain practical light upon the question of treatment.

Method of Measurement. Measurements are taken from a perpendicular plane behind the body, the distance of certain easily recognized bony landmarks being taken. The measurement aims to give a side elevation of certain points in the skeleton.

The method has been in use two years, and the material at my command consists of seventy-two observations made on normal boys between the ages of fifteen and nineteen years, by Dr. A. M. Greenwood, to whom I am indebted for much assistance in all my observations, of some six hundred observations on young women, made by the physical director of one of the women's colleges, of a hundred or more observations made by the writer and some assistants in the scoliosis clinic of the second surgical service of the Children's Hospital, and on a

series of about the same number made on cases of faulty attitude in private practice. Cases of marked scoliosis have not

FIG. 1.



Apparatus for measuring variations in attitude.

been taken into account in the following analysis, as they seemed to form a separate problem of much importance, to be

Fig. 2.

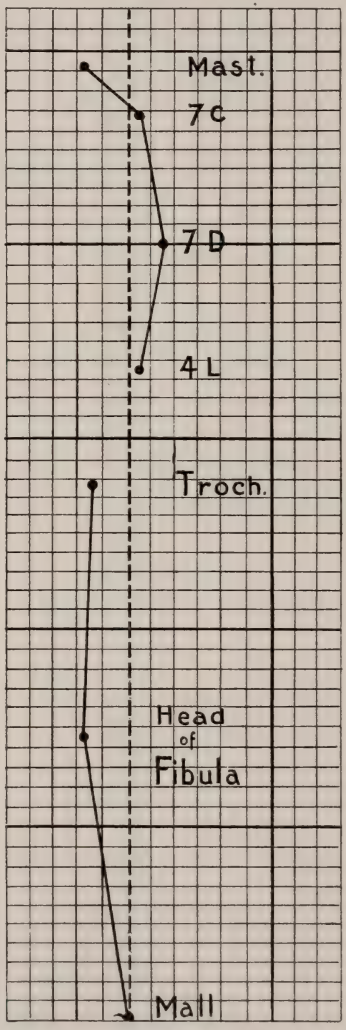


Fig. 2.—Graphic representation of standing position. (Case M. L.)

taken up after more information was obtained about the normal attitude and the common antero-posterior variations.

Fig. 3.—Average curve of 72 boys. (Greenwood.)
Fig. 4.—v. Meyer's normal.
Fig. 5.—Langer's normal.
Fig. 6.—Staffel's normal.
Fig. 7.—Curve of young adult female of good carriage.

FIG. 8.

Attitude type *a*. Photograph and tracing of same patient.

The apparatus by which the measurements are taken consists of the ordinary wooden upright, with a sliding arm used for measuring the height. On this sliding arm and at right-angles to it is a horizontal arm eighteen inches long, which is placed at six inches from the back surface of the upright rod. This back surface of the upright rod is taken as the perpendicular plane from which variations are to be noted, and the measurements are made from the sliding horizontal arm, which is always six inches distant from the back surface of the upright. Any point, therefore, more than six inches from the sliding horizontal arm is in front of the perpendicular plane agreed on, and any point less than six inches is behind it.

The middle of the external malleolus was taken as the lower end of the perpendicular plane from which measurements were to be made. The patient stands without boots, in a natural position, with the feet forming an angle of forty-five degrees, and with the middle of one malleolus opposite the back surface of the upright, the back of the patient, of course, being toward the sliding horizontal arm.

The measurements of the bony landmarks to be mentioned are then taken from the sliding horizontal arm, and the height at which each measurement is taken is recorded. This may be done, of course, either in inches or centimetres. Having then the height of each point desired as well as its distance from the ground, it is a simple matter to reproduce graphically the relation of these points by using ordinary co-ordinate paper and allowing one inch or one centimetre to each space on the paper. To secure uniformity of results, it may be assumed that the patient is seen facing to the left.

The landmarks taken for measurement were those which could be easily identified by touch. They are as follows from above downward:

1. The middle of the mastoid process.
2. The spine of the vertebra prominens.
3. The spine of the seventh dorsal vertebra. (On a level with the inferior angle of the scapula.)
4. The spine of the fourth lumbar vertebra. (On a level with the top of the iliac crest.)

5. The middle of the great trochanter.
6. The middle of the head of the fibula.
7. The middle of the external malleolus.

The measurement is taken by marking with a skin pencil the points to be measured. The patient is then placed with the back to the sliding arm and the outer malleoli opposite the back edge of the upright. In order to get the measurements before the patient becomes fatigued and sways it is necessary to work quickly. The mastoid measure is taken, and then the arm pushed rapidly down while the distances of the points from the upright are measured with a rule at each level. Having taken these down, it is necessary, if the curve is to be reproduced graphically, to record the height from the ground of each bony landmark, and the sliding arm is again pushed up and the level of each marked bony landmark recorded. By this division of the two measures the first and important one should be finished before the patient becomes unsteady, and in the second set swaying is of no account.

A typical measurement would be as follows:

CASE M. L. TYPE (A).

	Distance from upright.	*Height.*
Mastoid	$7\frac{3}{4}$ inches.	49 inches.
Seventh cervical	$5\frac{1}{2}$ "	$46\frac{1}{2}$ "
Seventh dorsal	$4\frac{1}{2}$ "	40 "
Fourth lumbar	$5\frac{1}{4}$ "	$33\frac{1}{2}$ "
Trochanter	$7\frac{1}{4}$ "	$27\frac{3}{4}$ "
Head of fibula	$7\frac{3}{4}$ "	$14\frac{1}{2}$ "
Malleolus	6 "	assumed to be 0 "

The curve is plotted by marking the points on the co-ordinate paper and drawing lines between them. As below the level of the fourth lumbar vertebra the line no longer follows the back outline of the body, but changes to the axis of the leg, the fourth lumbar and trochanter marks are not connected by a line.

Certain criticisms may be anticipated and answered in allowance.

With regard to the general accuracy of the method, it has been repeatedly tested by taking two successive independent

measurements of the same patient and comparing them, and by taking measurements on succeeding days and comparing them, with the result of finding that the two conformed on the whole, the type persisting and the chief difference being in slight swaying forward or back which was at times evident.

Measurements of the same patient taken by different persons with fair experience in the method have shown similar curves, swaying forward or back, which was at times evident.

The method is not intended to be mathematically accurate, but to give a fairly accurate graphic representation of the patient's method of standing. It has the advantage of being applicable in adults, where record by full-length photographs is not available, and the measurements can obviously be taken without objectionable exposure in the case of women.

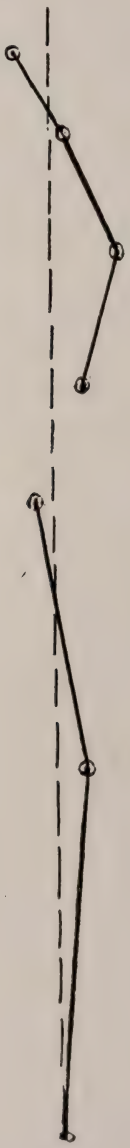
Before proceeding to consider the practical bearing of the results yielded by the method it may be said that the common type of faulty attitude, the one known as "round shoulders," has received very scant attention in American and English text-books on orthopedic surgery, and in a careful search through the orthopedic surgeries of Jackson Clarke, Kelly, Tubby, Reeves, Bradford, and Lovett, McCurdy, Moore, Sayre, Whitman, and Young only vague and general descriptions of the affection were to be found.

In the Transactions of the Orthopedic Association there have been a few articles dealing with the subject. In Volume I. is an article by Stillman discussing in general terms backward yielding of the spine. In Volume X., Bradford called attention to the contraction of the pectoral muscles in this condition, and, spoke of the effect of supporting-straps over the shoulders, which hold the weight of the clothes in causing it. In Volume X. is a paper by the writer on the relation of round shoulders to fatigue, and on the association of pronated foot and faulty attitude.

Brackett read a paper dealing with the varieties of faulty attitudes, with some classifications of deviations from the normal, before the Boston Physical Education Society in 1901. There are a few articles dealing with the subject of braces in round shoulders.

These are all the articles in English which it has been easy to find.

FIG. 9.



Attitude type *b*. Photograph and tracing of same patient.

In German, on the other hand, are numerous articles dealing not only with the normal attitude in standing, but with varia-

FIG. 10.

Attitude type *c* Photograph and tracing of same patient.

tions from the normal. But here there is but little agreement as to what the normal attitude is. The chief article dealing

with the variations from the normal is by Staffel.[1] The main articles on the subject are by the brothers Weber[2] and the following: Boegle,[3] Parou,[4] Henke,[5] Floriep,[6] Langer and H. Meyer.[7]

In such books on orthopedic surgery as those of Hoffa, Rédard, and Lüning and Schulthess are found abstracts from the above work, with the individual views of each author as to which of them is nearest to the truth as to the proper normal attitude.

In regard to variations from the normal as seen in faulty attitude there is, however, general agreement as to types, the classification of Staffel being on the whole followed.

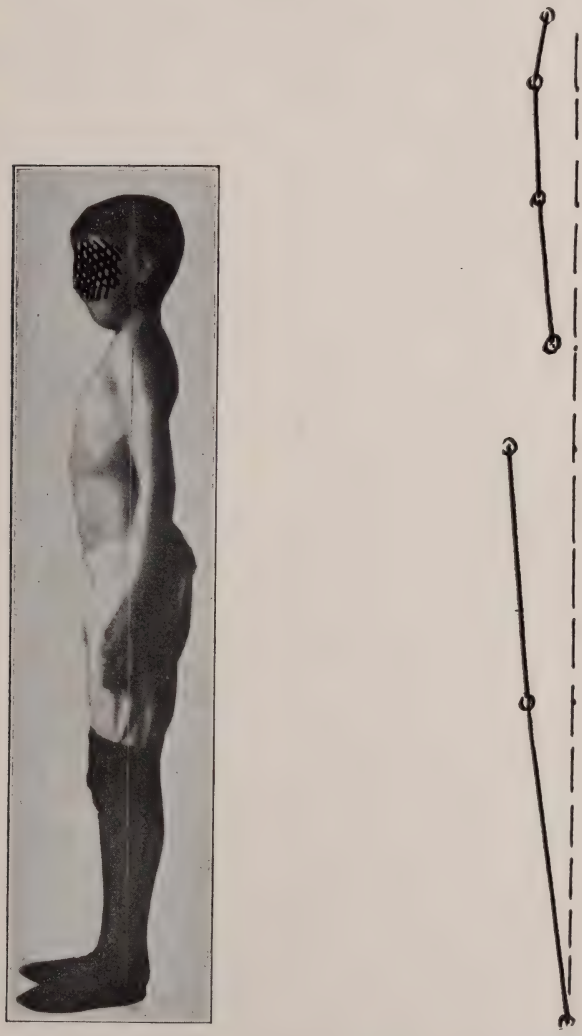
Cowlee, who has recently examined 2314 school children at Lausanne, divided abnormalities into (1) flat back; (2) round back; (3) lordosis; (4) kypholordosis, a classification practically the same. Schulthess uses a classification much like this, with different and more complex names. Rédard recognizes only kyphosis and lordosis. Hoffa follows Haffel.

The difficulty with the classifications of faulty attitudes seems to be that the antero-posterior outline of the spine alone has been chiefly considered and but little or no attention has been paid to the relation of the feet, legs, and pelvis to the spine and of the whole body to the perpendicular. And again no uniform system of measurement has been in use. Under these conditions we have been able to formulate only parts of the problem. The general attitude is likely to be imperfectly represented by any drawing or observation made on the spine alone, because it is obvious that a backward curve of the upper part of the spine cannot occur without disturbing the normal relation of all the supporting structures below it. Equilibrium must be maintained, and the necessary adjustment involves feet, legs, and pelvis in their relation to the spine and to the perpendicular.

[1] Franz Staffel. Die menschl. Haltungstypen, etc., Wiesbaden, 1889.
[2] Mechanik der mensch. Gehwerhzerage.
[3] Boegle. Ueber den Mechanismus des mensch. Ganges, 1885.
[4] Parou. Virchow's Archiv, 1864, xxxi. 1 und 2.
[5] Henke. Anat. und Mech. der Gelenke, p. 213.
[6] Floriep. Anat. für Künster, Leipzig, 1880, p. 40.
[7] Langer and H. Meyer. Anat. der äusserén Formen d. mensch. Körpers.

The practical points to be developed by a study of the results of such a system of measurement as that described should be as follows:

FIG. 11.



Attitude type *d*. Photograph and drawing of same patient.

1. What is the normal type of standing position in well-balanced individuals?

2. What are the variations from this type in faulty attitude?

3. What is the essential factor in producing faulty attitude? Is it to be found in spinal weakness, in an abnormal position of the pelvis, or in an improper base of support?

4. What should be the general scheme of treatment?

5. Can the results of treatment be formulated, and what change in attitude do they show?

Some of these questions can in a large measure be answered by the material already collected, while others cannot.

1. *The normal attitude* has been investigated and formulated in diagrammatic figures by many writers. These figures differ from each other, as would have been expected, not only because there has been no satisfactory system of measurement, but because the normal type of standing must be modified by age, sex, race, fashion, and occupation. A military cadet would not be likely to assume the same standing attitude as a woman of the same age who had worn tight clothes, heavy skirts, and pointed boots for five years.

Still, approaching the problem as one capable of general solution in the same way as it is considered by Meyer, Langer, Harlen, Henke, Staffel and others, the following facts are available.

The measurements of the seventy-two boys taken by Dr. Greenwood seemed the material most available to compare with the results of the writers mentioned. They were all healthy, well-developed boys, averaging eighteen years of age, and the individual tracings differed but little from each other. An average curve of the tracings is, therefore, representative of the standing position of these young men.

Tracings of the curves of the normal attitudes as represented by v. Meyer, Langer, and Staffel were then taken by marking on their figures the places of the bony landmarks adopted, connecting them with lines and considering them in their relation to a perpendicular erected through the external malleolus in each case. The normal of v. Meyer reproduced in that way was unlike any curve found in normal persons, while that of Langer is also unusual. The normal curve constructed from Staffel's figure is, however, practically identical with that of the seventy-two boys.

With regard to the curves of the six hundred college girls it has not been possible as yet to analyze them in detail. The

FIG. 12.

Staffel's round back. Diagram and tracing.

individual variations are much greater than in the males, and there is a general tendency to carry the body further forward and to hyperextend the knees, the lumbar curve, also, as one

would expect, being greater than in the males. Fig. 7 is a fairly representative curve of the women of the best apparent physique and carriage.

FIG. 13.

Staffel's round, hollow back. Diagram after tracing.

2. *Types of Variation in Faulty Attitude.* As no one classification of these types has been universally adopted, and as the classifications differ among themselves, it seemed best to start

afresh and see if these measurements of patients (mostly children) offered any basis of reasonable classification by which they might be divided into groups for study, to see what constant types of variation the curves showed, and to find out by photographs to what clinical types of faulty attitude these variations corresponded.

It was difficult to decide what factor in the attitude should be the basis for classification: whether it should be the relation of the trunk to the legs, of the pelvis to the perpendicular, of the whole swing of the body backward or forward, or of the relation of the points in the spine itself. On examining the graphic representations of the tracings of faulty attitude in this connection the most constant grouping seemed to be by the spinal curve. That is, the cases showed four types of spinal curve, and, arranged according to these types, the other characteristics of the curves seemed to be fairly constant in each group. It is not by any means sure that this classification is founded on the best basis or is of any value as it stands. It is simply presented to show that the essentials of the patient's attitude may be studied and a proper and accurate classification reached in time.

The four types of spinal curve were as follows:

Type A. A general curve (an exaggeration of the normal lines), where the spine from the mastoid to the fourth lumbar forms one general curve backward. As a rule, there is little lordosis in these cases (as shown by the relation of the fourth lumbar to the trochanter). The pelvis is, as a rule, well in front of the perpendicular, and the body axis lies generally in the perpendicular, but may be wholly in front of it, and in one case only lay behind it. The legs, as a rule, incline forward and are rarely hyperextended at the knee. This is the most frequent type and consists in a word of rounded back with little forward lumbar curve.

Type B. Backward projection greatest in the mid-dorsal region, the seventh cervical and mastoid points forming a straight line above it. There is generally lordosis, the pelvis is near the perpendicular, and the body axis lies, as a rule, behind the perpendicular. The legs are rather vertical, and if there is not

marked lordosis the knees are apt to be hyperextended. This type is second in frequency, and represents the seventh dorsal

Fig. 14.

Staffel's hollow back. Diagram and tracing.

point as the most prominent point backward, with some lordosis in the lumbar region.

Type C. The lower part of the back is straight, and the head runs forward from the seventh cervical. There is generally

FIG. 15.

Staffel's flat back. Diagram and tracing.

not much lordosis, the pelvis is not pushed forward, but is near the perpendicular, and the body axis lies back as a rule. The knees may or may not be hyperextended. In this case the

head is thrust forward from the upper part of the spine, and the body weight is thrown back.

The spinal points form a nearly or quite straight line. The

FIG. 16.

R. J. Tracing and photograph before treatment.

back is nearly flat, lordosis is marked, the pelvis is generally back, but it may be forward, and the knees generally somewhat flexed.

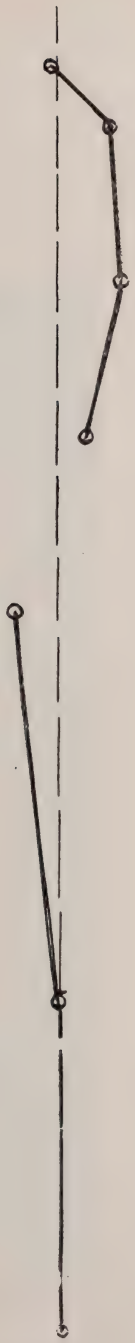
FIG. 16.

R. J. Tracing and photograph after treatment.

Fig. 17.

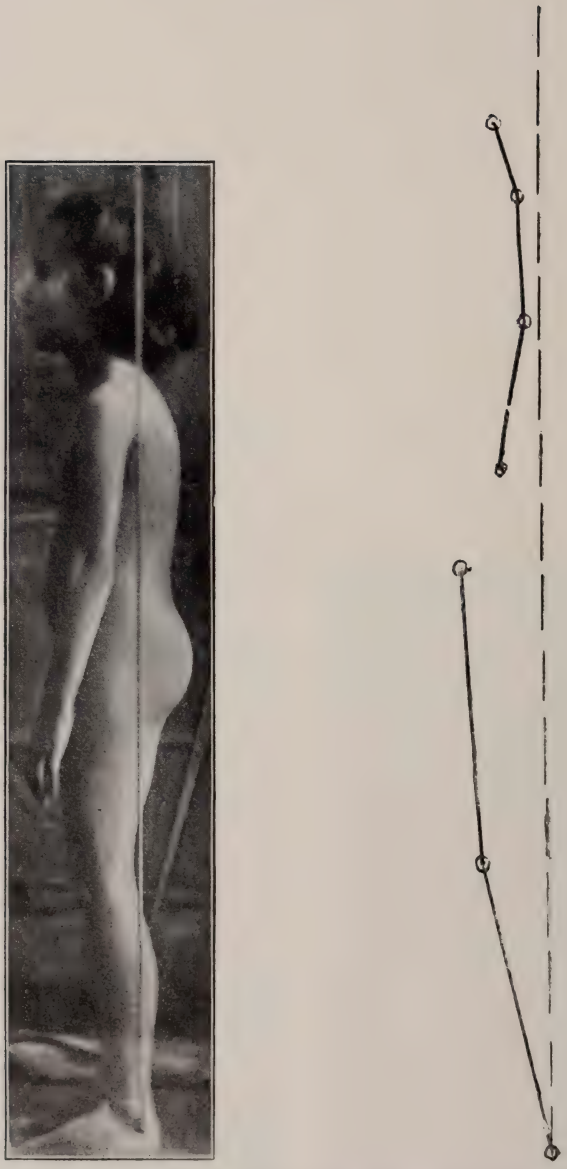
G. F. Tracing and photograph before treatment.

FIG. 17.



G. F. Tracing and photograph after treatment.

FIG. 18.



C. B. Tracing and photograph before treatment.

FIG. 18.

C. B. Tracing and photograph after treatment.

That these types are not quite constant, and therefore probably not very well separated, is shown by the fact that in tracings taken at considerable intervals occasionally the same case would appear in *Type A* and then in *Type B*, or vice versa.

Having formulated independently this classification of types of variation in faulty attitude from my tracings alone, and having rejected the other methods that I had previously tried, which took into account the relation of the legs and pelvis to the perpendicular, the relation of the whole attitude to the perpendicular, etc., as introducing too many inconstant elements, I was interested to see what relation these bore to the types formulated by Staffel. Points were marked on his figures corresponding to the bony landmarks selected, lines drawn, and a perpendicular erected through the external malleolus. To my surprise I found that his classification and my own were practically identical, as may be seen by the tracings. Group A in my classification corresponds to his "round back," Group B is his "round hollow back," Group C is his "hollow back," and Group D is his "flat back." The difference between Groups C and D in his classification is not so distinct as I found it.

The hyperextension of the legs and abnormal positions of the pelvis in many cases suggest that, possibly, some patients stand wrongly from some lack in the base of support. The frequent association of pronated foot with faulty attitude in growing children is of much significance.

3. The essential factor in producing faulty attitude cannot be formulated at this stage of the study. The primary cause is obviously muscular weakness; but whether it is general or confined chiefly to the spine or to the legs and pelvis cannot be definitely stated. As certain patients with round shoulders (to be discussed in Section 5) acquire a much more correct attitude under treatment without obvious change in spinal outline, it cannot be assumed off-hand that the spine is in all cases the primary seat of the difficulty.

4. As it has not been demonstrated that the origin of faulty attitude lies wholly in the spine it cannot be assumed that the gymnastic treatment should be wholly directed to the spine.

In general the gymnastic treatment should resemble the "setting up drill" of the military recruit, for exercises to straighten the spinal bowing and broaden the chest by themselves are only to be regarded as attacking part of the problem of treatment, for in many cases, at least, it is plainly evident that the vicious attitude is general as well as local. The treatment should, therefore, be general.

It is obvious that when the pelvis is pushed forward and the hips hyperextended ligamentous support is substituted for muscular and the whole attitude rendered vicious. Exercises for the abdominal muscles and the glutæi and hamstrings must be an essential part of the treatment in such cases. The raising of heavy weights brings into exercise all of the muscles concerned in maintaining the erect position, and is in that sense a selective exercise. Backward flexion and stretching of the spine is, of course, useful, but a study of the essentials of the whole position will show that these special exercises are of less importance than is often supposed. The analysis of the results of treatment will show that improved cases, as a rule, have been corrected more in their general balance than by any marked change in the spine. The importance of diminishing the muscular fatigue of these patients by daily enforced rest in addition to muscular exercise has been dwelt upon in another paper.[1] The same consideration applies to resting the muscles temporarily by light braces applied to maintain a more correct position in addition to gymnastic treatment.

5. In analyzing by this method of measurement the changes in the attitude of patients brought about by gymnastics extending over a considerable period of time certain interesting facts are to be found. There are six cases where back tracings and photographs before and after treatment are available. One showed no improvement after one year's treatment, four showed great improvement in their method of standing, but little or no change in the relation of the spinal points; one showed straightening of the spine.

The indication from the study of these cases and others which

[1] R. W. Lovett. TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. x.

cannot be presented on account of incompleteness of the records, is that in general the cure of the form of faulty attitude known as round shoulders is, in many cases, accomplished rather by a readjustment of the whole attitude, involving the relation of legs, pelvis, and head, rather than by any marked straightening of the spine. The bearing of this upon treatment is obvious.

The cases are as follows:

Case I.—C., in October, 1901, stood with the head forward and the seventh dorsal well back. The lower back was flat, the pelvis slightly forward, and the knees hyperextended. In May, 1902, the spinal outline was the same, but the knees were straight; the lumbar region was further forward, and the improvement had evidently been brought about by a change in the axis of the pelvis and not by any alteration in spinal outline.

Case II.—R. J., in April, 1901, stood with a general curve to the back, lumbar spine flat, and pelvis forward, with the axis of the legs inclined sharply forward. November, 1901, the spinal outline was unchanged, but the pelvis has been carried back, and the spine was more over it. The legs, instead of slanting forward, were upright and under the pelvis.

Case III.—G. F., February, 1901, general round of back pelvis forward, lumbar spine flat, knees hyperextended. October, 1901, slight change in spinal outline, the mastoid having moved up and back in relation to the seventh cervical, but the chief change was in moving back of the pelvis, increase in lumbar curve, and straightening of the legs.

Case IV.—C. B., January, 1901, general round to back lumbar spine, flat pelvis, very far forward, knees slightly bent, leg axes far forward, whole body-weight forward. November, 1901, *no marked change in outline of spine;* slight straightening, possibly; pelvis back, increase of lumbar curve, straightening of legs, and hyperextension of knees.

The conclusions from this paper would seem to be as follows: That the study of faulty attitude has been incomplete because

the spine alone has been considered rather than the relation of the legs and pelvis to the spine and the relation of the whole body to the perpendicular; that a uniform method of measurement and record is desirable; that the method described gives a side elevation of the whole attitude and the relation of legs, thighs, pelvis, spine, and head to each other and to the perpendicular; that the seat of faulty attitude is not as yet formulated; that gymnastic treatment should be general and local.

CONGENITAL ABSENCE OF THE CLAVICLES, WITH PHOTOGRAMS AND RADIOGRAMS. CLEIDO-CRANIAL DYSOSTOSIS.

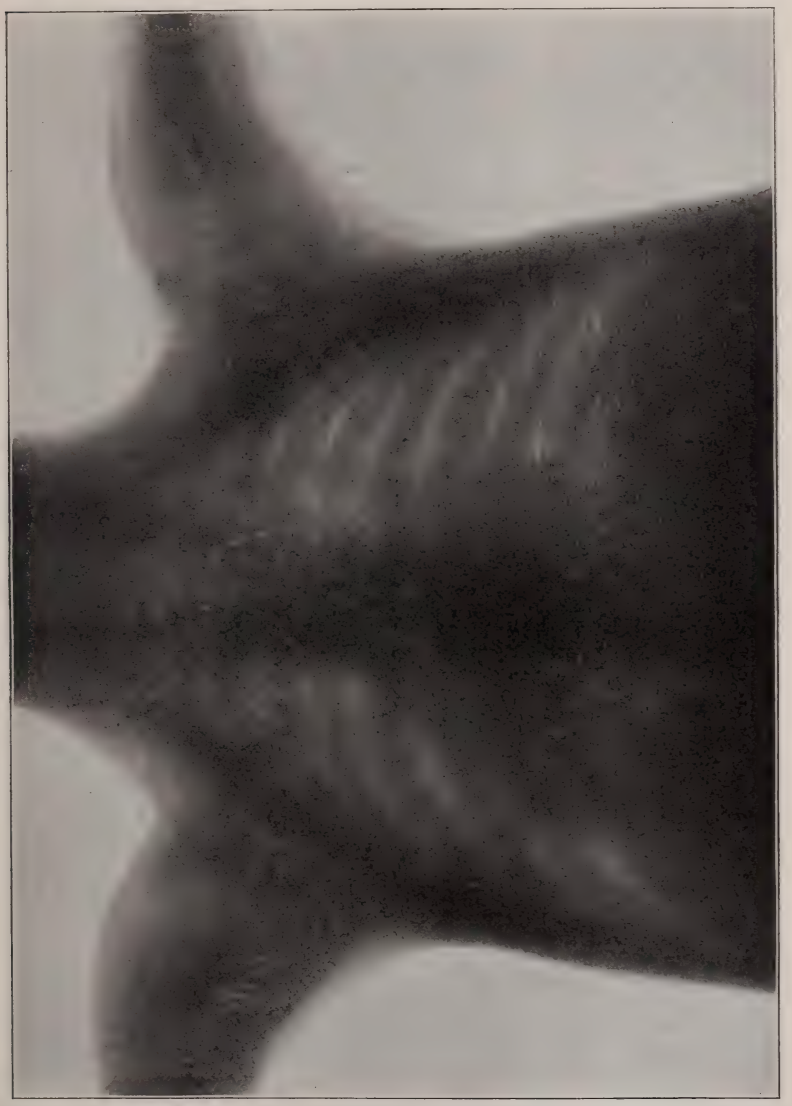
By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO.

The present paper is not in the shape it was when presented to the Association in Philadelphia in June. Another case has been added, and some recent literature bearing directly on the subject has been quoted. But as the paper was never anything more than a description, the changes are only in the direction of additions and amplifications.

At the meeting of the Association I presented the following description of Case I.:

The child was a three-year-old boy; he was normal mentally, but had marked evidences of rachitis, without having, however, in his long bones curvatures which required surgical intervention. An obvious lesion was a delayed ossification of the bones of the skull, both fontanelles and the frontal suture being widely open. There was no hydrocephalus, but the frontal bones were very prominent, the right the more so. He had on the left side only a rudimentary clavicle on palpation, and only the sternal half of the bone on the right side. The radiogram fails to show either of these as visible bones. He had deformed scapulæ, the spinous processes seeming to be too high on the body, and not as prominent as they should be, but the acromion processes were present and properly located. The supraspinati and infraspinati muscles seemed to be atrophied or absent, and so did the posterior halves of the deltoid muscles, but there must have been some muscular tissue in all of these locations, for the function of the shoulders was practically perfect, and the boy

could put either hand on his head, or behind his back, or hold his arms out sideways horizontally from his body. It was pos-



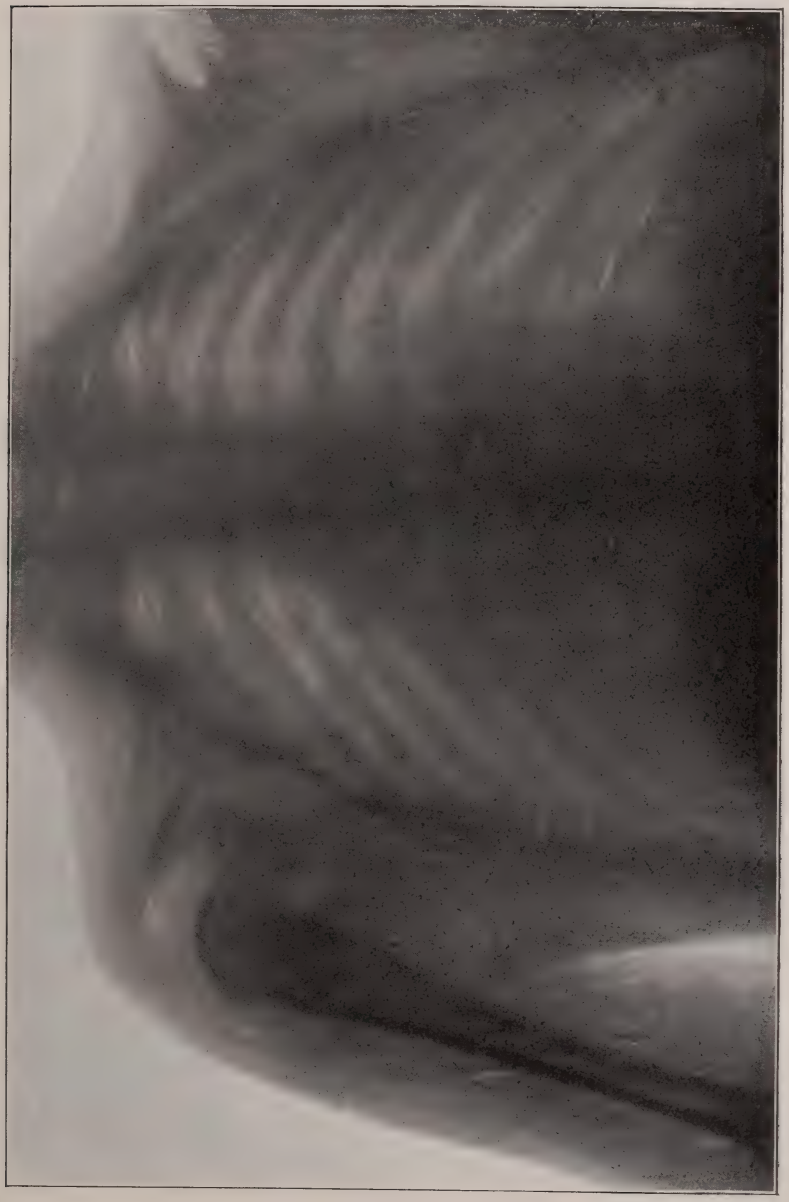
sible to pull the shoulders forward with very little force and to touch them together under the chin. The act caused no pain

or discomfort, and the shoulders returned spontaneously to their usual position as soon as they were released. The lack of the clavicles seemed to be no detriment to the child, and in

fact their absence had not been known, and was discovered by me during an examination for other conditions.

A second case is now added to the above. The child is a girl, seven years old, whom I first saw two years ago, suffering from

well-marked rachitis. She readily recovered from this, but became somewhat heavy and slow, and at times, when she was



tired, she limped. I examined her several times to discover the cause of the limp, and in the course of one examination found the scapulæ higher than normal and very prominent, especially in their upper parts. There seemed to be much the same fault to be found with the bone as in the previous case, and the supraspinati and infraspinati muscles seemed to be atrophied, even though all motions appeared normal. I sent the child to Dr. L. Newmark for a neurological examination, and he reported that no lesion of the nervous or muscular systems was present, and noted the absence of the clavicles. Further examination failed to show even rudimentary clavicles, and none appeared in a radiogram. In addition to the absence of the clavicles the sternum is much depressed. The fontanelles and sutures in the skull have closed, but there are well-marked depressions along the suture lines, including the frontal suture, and the head is large, with prominent frontal and parietal eminences. The bridge of the nose is not sunken in, but the line of the bridge is quite concave. Mentally the child is normal. In this case, as in the other, the shoulders can be made to touch each other under the chin, easily and painlessly, but not by the voluntary effort of the child. When they are released from this position they return spontaneously to their usual one, and their unusual mobility does not seem to interfere with the use of the arms.

In *La Tribune Medicale*, July 23, 1902, is reported a lecture by M. Pierre Marie on "La Dysostose Cleidocranienne," and it describes four cases which are similar to my two.

Case I.—A woman with a large head, prominent frontal and parietal bones, grooves along the suture lines and open fontanelles. She had also a high arch to her palate and evidence that the palatal processes of the bones had not fully united, though there was no cleft palate. Her teeth were irregular. Of the clavicles she had sternal fragments only.

Case II.—A child, daughter of the woman just mentioned, who was like her mother in all particulars except that she had no clavicles at all, and she had had a persistence of the first dentition, the teeth being at the same time good.

The amplitude of movement of the shoulders in these two cases was the same as in those I have described, and while in my children no disability had developed because of the lack of the clavicle, in the woman reported disability had developed, and she could not hold her arms out straight before her, nor lift nor carry her babies easily.

Case III.—A man with a very large head and the usual prominent bones and grooves and open fontanelles. He had a narrow and cleft palate and bad and irregular teeth. Of the clavicles he had fragments at each end of the bones.

Case IV.—A boy, son of the man just mentioned, who was like his father in all essential particulars.

The man, Case III., had developed syringomyelia, and although he formerly had been a skilled artisan, he was then wholly incapacitated for any work.

Marie points out the evident hereditary character of these odd malformations, but says it has never been known to run more than two generations, and that therefore there must be a tendency for a return to the normal type. He notes that all his patients showed signs of rachitis in addition to the malformation, and emphasizes the fact that they may develop syringomyelia and hydrocephalus.

I have asked the two family physicians of my two chance cases to look up the heredity element, and Dr. J. T. Jones, at Grass Valley, California, reports that both father and mother of my boy case are properly and well formed and have clavicles. Dr. Geo. H. Aiken, of Fresno, California, reports of the father of the girl case: "I find the chest full, broad, and very well developed. There is no absence of the clavicles, but evidence of fractures of both, with overlapping and imperfect union. The fracture of the left clavicle occurred when he was two years old. The head is large and square, with the top decidedly flattened. I find no special depression along the whole length of the sagittal suture, but quite a marked depression at and just posterior to the anterior fontanelle. I believe he was rachitic in early life."

The mother of the child I have myself examined and she is normal.

Unless, then, there is some heredity force possible in my girl case, the father having a large head with a depression at the anterior fontanelle site, my cases must be chance occurrences of this particular type of imperfect and aberrant development.

DISCUSSION.

Dr. Steele called attention to the fact that he had exhibited at the 1893 meeting of the Association an adult female dwarfed skeleton, in which both clavicles were deficient in their acromial ends for one-half or more of their length. Each bone was a slender spicule, compressed from before backward, arched a little from end to end, convex forward, and the sternal end thicker than the acromial end. Each was joined firmly by ligament to the sternum in the usual place, and fastened to the first costal cartilage by a rhomboid ligament. The acromial end was connected by a fibrous band both to the acromion process and the coraco-acromial ligament on the left side and to the coraco-acromial ligament alone on the right side. The right clavicle measured 47 mm. in length and the left one 49 mm. There also existed marked anomalies in the skull, spine, and pelvis.

This skeleton was prepared some fifteen years ago by Professor Todd, then of the Missouri Medical College, and more recently has been fully described in the *Journal of Anatomy and Physics*, vol. xxxiii., by R. J. Terry, M.D., Professor of Anatomy, Medical Department, Washington University, and to whom I am indebted for the above particulars.

Dr. Phil. Hoffmann, of St. Louis, said that, so far as he knew, the skeleton referred to by Dr. Steele was the only prepared anatomical specimen of its kind in existence. Dr. Terry, of St. Louis, had reported several instances before the Anatomical Society of absence of the clavicle, and so far as he knew in all

the reported cases these persons had been able to use their arms as well as if the clavicles were present. This anatomical peculiarity was a characteristic of the cat family, so that perhaps the occurrence in the human species indicated merely a reversion in type.

Dr. G. G. Davis thought there must be some loss of function in these cases. One of the main functions of the clavicle was in promoting abduction. Animals having no clavicles have an antero-posterior movement of the upper extremity, but practically no motion of abduction. On the contrary, animals, such as birds, possessing well-marked motion of abduction have not only clavicles but another bone which is practically a second clavicle. Therefore some loss of abduction is to be expected.

Dr. Sherman said that it was true there was a certain loss of function if one could compare accurately the two shoulders of the same individual with the clavicle absent on one side; roughly speaking, however, there was no apparent loss of function. In one case of ununited fracture of one clavicle a comparison of the two sides had certainly shown some loss of function.

THE MALIGNANCY OF JOINT TUBERCULOSIS, ILLUSTRATED BY A SERIES OF FORTY-SEVEN CASES.

By CHARLES F. PAINTER, M.D.,
BOSTON.

I HAVE chosen this title because I believe that a so-called healed tuberculous bone lesion is a constant menace to its possessor. This conclusion has been reached from a consideration of the following facts: (*a*) In our metropolitan communities large numbers of children have been treated during the past thirty years at children's hospitals. (*b*) We are coming to recognize errors in the diagnosis of the character of some joint lesions formerly regarded as tuberculous, which removes from this category a considerable number of the best results, already doubtless classified among the cured cases. These patients, coming from a station in life that naturally patronize public dispensaries, do not present themselves in the proportion they should among the patrons of clinics for other diseases. They are not much in evidence in the street, in the schools, or other public places. They cannot conceal their deformities as a rule, and a fair inference is that they must either become incapacitated from association with their fellows or else succumb to some other or their old disease.

Obviously, then, we are not to look for these cases in general clinics in numbers sufficiently large from which to draw conclusions.

During the past seven or eight years at the orthopedic clinic of the Carney Hospital a considerable number of adults with tuberculous joint diseases have presented themselves (about 130 cases of Pott's disease, 180 of hip, and a lesser number in the

smaller joints). By far the greater proportion of these were patients with disease, active from the outset, referred from other clinics where there were no facilities for treatment, or age debarred them from further attendance. A very much smaller proportion were primary in adult life and came directly for their first treatment. A very considerable number came to begin treatment a second time after a greater or lesser interval of health.

It is to this type of the disease that I have ascribed the term malignant. The pathologist recognizes among tumors a variety that manifest a tendency to recurrence after removal, either in the local scar, or by metastasis, or both. There are other reasons for the classifications of tumors, depending on their morphology, but in a broad, general way the division founded on the above-mentioned phenomenon has gained general acceptance. The pathologist also recognizes certain inflammatory tumors, and classifies them under the head of granulomata, and in this classification tuberculosis is placed. The recent strife which has been going on over the infective character of carcinoma is hardly passed, and is by no means settled.

I will not attempt to justify this title, then, on pathological, but chiefly on clinical grounds.

Barker and Croft, writing in the *British Medical Journal*, have already drawn attention to this tendency to late recurrence in bone tuberculosis.

Our orthopedic text-books have compiled numerous collections of statistics regarding the prognosis in the various joint lesions. One of the conclusions drawn from these is that once convalescence is well established in childhood (and by convalescence is meant spasm disappeared, general health restored, and apparatus discarded), the patient is cured, and that though some deformity may remain, causing more or less discomfort, the particular bone lesions for which treatment was undergone are practically well. The percentage of recovery during the first decade is said to be 65 per cent., with an increasing ratio of bad results for the succeeding decades. The period of time covered by the observations upon which these percentages were based in no case exceeded eight years, and in one series of 39 cases the

average interval which elapsed between the end of the treatment of the initial disease and its recrudescence was twelve and a half years—*i. e.*, four and a half years in excess of the maximum period at which statistics were obtained in the text-books. It would appear, then, that had the statistics upon which these progresses were made been procured after a longer interval, the percentage of recovery would need to be modified, or else we are dealing with a more severe type of disease in this community. This last possibility is partly offset by the fact that into these percentages enter some of the cases treated here at our own Children's Hospital, many of which doubtless figure in both statistics.

It has been the commonly accepted belief that the danger from tuberculous bone disease lay chiefly in the liability of its extension to the viscera—*i. e.*, its metastasis, and in a certain proportion of the cases this is true. This feeling has not found expression in our ideas of treatment, for if it had, radical removal of the focus would have been tried earlier. In this series of cases, 38 of the recurrences were at the seat of the old disease alone, 5 were both local and elsewhere, whereas only 4 were purely metastatic. These 4 metastases were pulmonary, in the genito-urinary tract and elsewhere in the osseous system.

Traumatism has been directly associated with the relapse in about 25 per cent. of the cases. I have been a little disappointed in looking up the statistics not to find it more frequent, for my preconceived clinical impressions were that it would be constantly associated. I had felt that this would be true because of the way in which repair takes place in bone tuberculosis. The process is analogous to that in the lung, viz., organization of the granulation tissue thrown out about the point of infection. Thus the bacilli become encapsulated, but owing to their tenacity of life they remain pathogenic for indefinite periods, and all that is needed to permit them to resume their activities is some violence causing a rupture of this protective wall of granulation or a lowering of the resistance of the tissues to such a degree that the bacilli can break through. It matters little which cause operates to bring this about, the result is the same.

Two recent operations upon old tuberculous knees have emphasized this method of repair. In one case an excision was done for deformity, and in the other the joint was opened for acute symptoms in a relapsing case. In the first the disease had been in the internal condyle, and on opening the joint there were no signs of the old disease except for a thin shell of bone over a cavity in the internal condyle, which was lined with well-organized granulation tissue, and contained about one-half ounce of fluid, which was quite clear except for a few old flocculi. A similar condition prevailed in the second case, except that there were two cavities, one in the tibia and one in the femur. In the last case, which had been quiescent for five years and the patient had used the joint freely at her work as a mill hand, the disease had become quite active, and the synovial membrane about the old encapsulation was freshly infected, having all the appearances of being a new process.

In these cases it was perfectly obvious that direct violence from the outside, or even from the use of the limb, stiff as it was, would be very liable to disrupt the sac inclosing the old focus. In fact, the conditions which surround an adult who has a stiff hip or knee or an ankylosed spine, the result of tuberculous disease, must be very favorable indeed if the wear and tear of life and the trauma of ordinary use, leaving out of consideration the unusual and accidental traumata to which we are all liable, does not stir up the old process even after many years of latency. The existence of deformity immensely aggravates the liability to recrudescence, as the strain at the site of the old disease is very much greater under such circumstances. A slight trauma can exert great force when communicated to a diseased joint through a limb ankylosed in a bad position, and I feel confident that it is in this manner that most of the relapses are caused.

To revert to the text-books, we find them in practical accord as to the difference in the prognosis among children and adults. Fewer and fewer cases recover the later in life the disease manifests itself. This is due to two principal causes, I believe. In the first place the existence of deformities, which is the rule, and among which we may include ankylosis and shortening (for they operate in the same way), not only puts the diseased joint

to a disadvantage, but injures the general health of the individual as well.

In the second place, adult tissues have not the resistive and reparative power that the same tissues have in the growing period of life. They will not withstand from without or within what they would in earlier years, neither will they as firmly wall off a process that becomes active from any cause.

As the cases have been observed at the clinic, however, the ones in which the disease ran its acute course in childhood and relapsed in adult life did less well, as a rule, than those coming for treatment for the first time in adult life. Such patients, however, should not be compared with those forming the subject of this paper, for we have not the necessary data on the primary adult cases which have apparently recovered, upon which to base the comparison.

Treatment. The treatment of tuberculous joint disease is undergoing considerable modification. The tendency is toward more and more complete fixation in childhood in recognition of the fact that deformity can thus be prevented more readily and healing of the local process can be more firmly established, the accomplishment of either of which means less likelihood of relapse.

Operation in adults are undertaken earlier and more radically, because it is found that excision gives greater immunity from extension of the disease, locally or systemically, even though the ensuing functional result may be less satisfactory than ankylosis in a good position may be.

Such facts as this table show should lead us, it seems to me, to regard joint tuberculosis in childhood in a more serious light than we have been in the habit of doing. Conservatism has given such apparently good results during the average period that cases are under observation that we have been content to rest our treatment upon fixation in some form, with surgical interference as a last resort. Now that there is a wider knowledge of the symptomatology of joint disease among the profession diagnoses are made much earlier than formerly. More refined methods are now in our possession for examining joints and determining the character of their lesions, so that we cannot

only determine with certainty that we are dealing with tuberculosis, but where in the joint the lesion is situated; I refer, of course, to the use of tuberculin and the X-ray. In view of these facts, I think we are justified in exploring articulations that we otherwise should leave alone, in order to eradicate if possible a disease which, if left to heal under prolonged treatment, is a source of constant danger to the individual. This, however, is a field to be approached not rashly, but with conservative radicalism, and I feel confident that with proper care in selection good results will follow.

The cases which heal and relapse should be treated much more energetically than is customary. This is desirable, because their tendency is to do badly, and because the onset of the recrudescence represents a time when the process is active in the smallest possible area of the joint, the bulk of the active disease being walled off from the rest of the joint, and, therefore, much more amenable to operative removal even than at the very outset of the disease. Exploratory incisions and careful dissection in these cases will oftentimes effectively get rid of disease with much less mutilation than an excision.

The climatic treatment for joint tuberculosis as well as for the pulmonary form is being more and more used. It is not necessary to go to the pulmonary resorts to secure this. It can be obtained at home by removing the patient into the open air. This has been carried out in tents with most gratifying results in the hands of McKenzie and Galloway, in Toronto. In the treatment of septic conditions the value of this sort of treatment has been long recognized. The bad results in tuberculosis of any form are due to superimposed septic infections, virtually a septicæmia, and, therefore, we have all the more reason for urging the open-air treatment which gives such good results in septic cases. The following table presents in perhaps a more graphic manner the observations upon which this paper is based. Its principal facts are epitomized as follows:

1. Tuberculous disease of joints tends to recur after apparent cure in a considerable proportion of cases.

2. This recurrence is most commonly a local one. Metastases are not common.

3. Trauma, direct or indirect, is frequently associated with the recurrence. Indirect trauma is probably the exciting cause of the recurrences, especially where partial ankylosis or deformity exists.

4. Patients who have suffered from bone and joint tuberculosis should be cautioned that they are not well when symptoms have ceased, and that reasonable care must be exercised to avoid recrudescences.

5. Deformity and shortening should be corrected as far and as accurately as possible to lessen the chance of recrudescence.

6. Mechanical treatment, especially fixation, should be used in the acute conditions in childhood. Exploratory interference where discretion is used, with a view to removal of isolated foci, is advisable in many cases in children, and is to be urged in the majority of the recrudescences, if seen early. Recognition of the fact that patients with hip disease, Pott's disease, and tumor albus have tuberculosis just as much as if they had phthisis, and should be treated accordingly, must be insisted upon.

Statistics. Thirty cases were treated with apparatus. Pott's disease, 16; hip disease, 17; tumor albus, 10; ilium, 1; ankle, 1; shoulder, 1. Abscess occurred in 33 cases; absent in 14. Average age at the time of exacerbation, twenty-eight years.

Average duration of quiescence in 45 of these cases, twelve and a half years. Of these 47 cases, 29 were males and 18 were females.

The following are the cases in detail upon which the foregoing article is based:

Case I.—Mr. E. A. D., aged forty-one years. Seen with Dr. Bartlett, of Woburn. Diagnosis: Pott's disease. Disease began at one and a half years of age. Jackets worn until twenty years of age. After that nothing in the way of apparatus, and has been in active business. First seen in October, 1897. The previous winter (1896) had poor appetite, and increasing weakness. In August, 1897, a severe attack of indigestion. Since then legs have been giving out. At times numbness of anterior surfaces of left thigh and right leg. Better when lying down.

Examination. Very short man; large kyphos in lower dorsal; exaggerated reflex in ankles and knees; left leg the worse. Treatment, brace.

Case II.—Mr. G. E. C., aged thirty years. Seen with Dr. John Homans. Diagnosis: Hip disease. Twenty-two years ago first symptoms of hip disease appeared in right hip. Abscess running for three years, then remained healed for three years, and since then at about three-year intervals sinuses open. Has worn no apparatus since the first. Sinuses now have been closed three years, and comes on account of muscle strain due to deformity.

Case III.—Mr. C., aged twenty-seven years. Seen with Dr. G. C. Clement, of Haverhill. Diagnosis: Tumor albus. Tumor albus first noted ten years ago. No symptoms during the past five years. Now knee is flexed at a right angle; hot and tender; several sinuses of a year's duration. Excision performed.

Case IV.—Mr. H. K. D., aged thirty-three years. Seen with Dr. Paul Thorndike. Diagnosis: Hip disease. Disease in left hip when two years of age; sick until he was seven. Has always used crutches or cane on account of four and a half inches of shortening. Two years ago abscess formed over left trochanter. This has discharged practically ever since. Some signs of genito-urinary tuberculosis.

Case V.—Mr. G. P. B., aged twenty-seven years. Diagnosis: Tumor albus. Seen November 19, 1897. Eight years ago abscess appeared on outer side of calf. A month or two later abscess formed and broke on inner side of thigh above the knee. A few months later large abscess right on side of spine in lower lumbar region. In all he was laid up six months, and the left knee was flexed at forty-five degrees, with about ten degrees of motion. Attempt made to correct position, and the disease was made more active. Suppuration ensued and an excision of the knee-joint was finally done, which, after over a year, has permanently healed.

Case VI.—Mrs. H. M. Q., aged fifty years. Diagnosis: Pott's disease. Seen October 3, 1899. Knuckle gradually developed during the five or six years previous to her twenty-fifth year. At that time it was so bad that she wore a brace, which she did not give up until she was thirty-five years of age, and then discarded apparatus, as she was feeling perfectly well, and for a number of years went without any support. Nine years ago the chest became deformed and an abscess appeared, which discharged in front, evidently coming from caries of the rib. At the date of this visit, October, 1899, a spring-back brace was applied to take the place of her jacket.

Case VII.—Mrs. W. P., aged fifty-four years. Seen with Dr. F. G. Curtis. Diagnosis: Tumor albus. Seen June 23, 1899. Twenty years ago had first trouble with the left knee, followed by an abscess which discharged for several weeks. In bed for four months. Was then well except that motion was not free until eleven months ago, at which time acute trouble began, and has gradually grown worse.

Case VIII.—Mr. R. W., aged twenty-five years. Seen with Dr. C. A. Porter. Diagnosis: Pott's disease. Seen December 6, 1899. Pott's disease developed first during the fifth year. Desultory treatment for a few years. Ten years ago an abscess on the right side in the groin, which discharged for a month. Has used crutches for eleven years because of weakness of the left leg. Considered himself well, however, until August, 1899, when pain and tenderness appeared in the right hip, posteriorly. This disappeared under poultice, to return a few weeks ago below the left anterior spine, and spontaneously opened. Marked knuckle in lower lumbar region with little motion in the left hip. Indolent granulating area below the anterior-superior spine, with moderate discharge. Free opening made in back, which is still discharging in summer of 1901.

Case IX.—Mrs. H. S., aged forty-one years. Seen with Dr. M. H. Richardson. Diagnosis: Hip disease, double. Seen August 12, 1901. Since she was five years of age has had trouble

with the right hip and has been under treatment at intervals all her life for this trouble. At the present time she comes because of discharging sinuses which have developed over outer side of thigh below the trochanter.

Examination shows the right hip flexed and adducted and ankylosed, with sinuses from the crest of the ilium behind, halfway down the thigh; two of these are now discharging. Similar ones on the other leg, but no discharge. A few degrees of motion in the left hip. General condition, except for certain amount of neurasthenia, very good.

Case X.—Miss G. R., aged twenty-six years. Diagnosis: Hip disease. Seen March 23, 1901. Has had scrofula a number of years, chiefly manifesting itself by abscesses in the chest wall and in the axillæ. Three years ago an abscess appeared in the left hip, and since then the hip has been operated upon several times, the last time in the winter of 1900. Now the sinus has spontaneously opened.

On examination the patient is in poor general condition, with old tuberculous disease of the ilium on the right, with discharge from two sinuses.

Case XI.—F. D., aged eighteen years. Seen first in April, 1900. Pott's disease since two years of age. Been under treatment ever since, though disease has been quiescent for ten years. Deformity was so great as to impair respiratory action, and this kept patient's general health poor. Paraplegia for nine months at the fourth year. Paraplegia, second attack, for five months now. No abscess.

Case XII.—Peter McC., aged eighteen years. Seen September 5, 1896. Diagnosis: Pott's disease. Kyphos since early childhood. Perfectly well until two months ago—July, 1896—when he had weakness in leg, and now walks with marked paraplegic gait. Exaggerated knee-jerks and clonus. In the house five weeks, and was much improved, but remained so only a few days when the former symptoms returned and he entered the Out-patient Department again March 8, 1897, with paraplegia.

Referred to Boston City Hospital for laminectomy. Is a newsboy actively at work now, in 1902. Laminectomy was not performed.

Case XIII.—W. A. F., male, aged twenty-two years. Seen November 2, 1896. Diagnosis: Hip disease. Five years ago fell, striking on left hip. In bed five weeks. Got up on crutches for five or six months. Since then has been a little lame, and has occasionally had some pain in the hip after prolonged use. General health is good.

Examination. Marked atrophy of left thigh; all motions limited by muscular spasm; pain referred to trochanter.

Case XIV.—D. C., male, aged twenty-one years. Seen November 30, 1896. Diagnosis: Hip disease. Disease began at two and a half years. Abscesses during six or seven years; treated at the Children's Hospital. Six months past had considerable pain in the knee and calf. From the eighth to the twentieth year interval of quiescence.

Examination. Trochanter above Nélaton's line; fifteen degrees of permanent and fifteen degrees of apparent adduction; five inches of apparent and three and one quarter inches of real shortening. Atrophy of thigh, three and one-half inches; calf, two inches. Fitted with splint.

Case XV.—N. O., male, aged nineteen years. Seen January 7, 1897. Diagnosis: Hip disease. Disease began during his first year. Abscesses; always lame. Has not been able to be about until the last five or six years. No abscess for ten years. No pain or acute symptoms until three or four weeks ago, when an abscess appeared in one of the old scars, which has been discharging ever since.

Examination. Left leg adducted; dislocated on the dorsum. Half an inch of real and four and a half inches of apparent shortening. Thirty degrees of motion in flexion. Marked curvature of the spine. Extreme atrophy. Several scars, one of which is discharging behind the trochanter. Gant's osteotomy performed to correct position.

Case XVI.—A. M., female, aged twenty-five years. Seen March 11, 1897. Diagnosis: Tumor albus. Disease was acute at the eighth year. Swelling and pain on motion, and contractures. An interval of five years when she was perfectly comfortable and got about normally. In the last three years has been troubled with pain and the leg has been drawing up more.

Examination. Well-developed woman; right knee flexed to nearly right angle. Twenty degrees of motion without pain. Marked knock-knee.

Case XVII.—J. C., male, aged twenty-six years. Seen March 11, 1897. Diagnosis: Hip disease. At three years, following a fall, discharging sinus for some time about the hip, which eventually healed, and no trouble until two or three years ago. Pain has been gradually increasing in the hip and knee, with an increasing disability and limp.

Examination. Right leg three inches shorter than left; five inches atrophy of thigh, one and three-quarter inches atrophy of calf; trochanter above Nélaton's line. Motions in flexion to a right angle; abduction and rotation impossible.

Case XVIII.—O. A., male, aged thirty-nine years. Seen April 23, 1897. Diagnosis: Hip disease. Fifteen years ago had a fistula. One year ago broke the right lower leg, getting up from which walked lame in the hip, and now cannot use the leg more than one hour at a time. Pains worse at night. One and a half inches atrophy of thigh, one-half inch atrophy of calf. Right leg one inch longer than left. Forty-five degrees permanent flexion; thigh adducted and spasm restricts all motions; thickening of trochanter.

Case XIX.—C. T., male, aged seventeen years. Seen May 24, 1897. Diagnosis: Pott's disease. Treated in the Children's Hospital at fifteen months of age, and at the Good Samaritan fourteen years ago. Between the age of fourteen and sixteen years has been very well. In the past year has begun to fail. Considerable pain in the right side and the right knee.

Examination. Poorly-developed child. Marked kyphos in the mid-dorsal region; right leg flexed forty-five degrees, apparently due to psoas contraction. Motions in left hip, except extension, quite free. No abscess to be felt. Later (June 7th) abscess in iliac region showed itself.

Case XX.—C. H. P., male, aged forty-seven years. Diagnosis: Tuberculosis of ankle. At one year of age had scarlet fever, and following it hip disease, with dislocation of the hip. Recovered all right, and at thirteen years of age was entirely well except for deformity, and has earned his living ever since. Two and a half years ago sprained his right ankle, and four months later swelling had so increased that he was obliged to give up work, when abscess finally formed and discharged, and has continued ever since. On account of age and the severity of the condition at the ankle, which was evidently a tuberculous type clinically and physiologically, the leg was amputated at the point of election.

Case XXI.—J. B., male, aged twenty-three years. Seen December 3, 1897. Diagnosis: Pott's disease. When four years of age had symptoms of tuberculosis of spine. Disease was acute after about nine months; was in bed for sixteen weeks, then wore a leather collar. At the age of nine an abscess appeared in the neck; at fourteen years of age had an attack of what was called chorea, but was paraplegic in the arms, which lasted for three months. In March, 1897, having been previously well for ten years, pain in back began, which extended down his left side.

Examination showed a poorly-developed boy. Chin drops on to chest, with a large kyphos in the lower cervical region, and an old cicatrix on the right side of neck, healed. In the lower dorsal region, at the eighth spinous process, a sharp kyphos which represents apparently a fresh focus.

Case XXII.—J. C., male, aged twenty-seven years. Seen December 3, 1897. Diagnosis: Pott's disease. Six months before

entrance noticed swelling on right side of back. Was operated upon four weeks before entrance and a large abscess drained.

Examination. A small rounded prominence of the spine in upper lumbar region involving third and fourth vertebræ. Lumbar curve obliterated. Motions limited. Two sinuses moderately discharging in right lumbar region. On December 31st of the same year a leather jacket was fitted. There was a discharge at that time from the sinuses. From that date to July, 1901, patient was absolutely well, did his work and had no symptoms. The old sinus never discharged. At this last date an abscess appeared. Operated upon in July and a large tuberculous abscess drained, apparently coming from the pelvis. In October, 1901, a convalescent brace was applied and was worn until January, when he was readmitted to the hospital in a wretched condition, with marked signs of phthisis, and is now, April 4, 1902, dying of the disease, with extensive suppurative changes at the seat of the old focus.

Case XXIII.—E. L., woman, aged twenty-six years. Seen January 31, 1898. Diagnosis: Hip disease. When she was seventeen years of age had some trouble with the right hip. Pain and some flexion deformity. Has always been able, however, to work until one week before entrance. She had at that time a great deal of pain in the hip, particularly at night, and has noticed that the leg has been more turned out and has lost flesh. On examination there were twenty-five degrees of flexion in adduction, three inches actual shortening, two and a half inches of atrophy of the thigh, one and a half inches atrophy of the calf. Admitted to the house and operated upon, at which time a tuberculous abscess was found in the neck of the femur, which had destroyed practically the whole medullary part of the bone, leaving only a thin shell of the cortex. Excision of the hip performed in February, 1898, from which she made a perfect recovery, and has remained well and has been at work ever since, with the exception that a small sinus has opened in the lower end of the incision and is discharging slightly from time to time.

Case XXIV.—T. H. M., male, aged twenty-two years. Seen May 23, 1898. Diagnosis: Hip disease. Disease began at four

years. There has always been some deformity, which has occasioned some muscle-strain. Eight years ago had an abscess which discharged for six months and healed. Reopened April 10, 1898, and has discharged ever since. Has lost fifteen pounds. Said to have had pneumonia just previous to its opening the last time.

Examination. Firmly ankylosed hip, flexed and abducted. Three healed sinuses, and one discharging. Examination of chest negative.

Case XXV.—W. D., male, aged twenty years. Seen August 8, 1898. Diagnosis: Pott's and hip disease. Pott's disease when seven years of age, and for many years, just how long not known, the right leg has been drawn up and has been short. No acute symptoms until one year ago, when patient noted that hip was drawn up and it was more difficult to walk. Pain referred to the knee.

Examination. Extreme deformity of back, right-angle flexion of leg; considerable spasm about hip. Recommended for excision in house.

Case XXVI.—H. W. B., male, aged forty years. Seen September 9, 1898. Diagnosis: Hip disease. When fifteen years old suffered severe trauma. Had trouble with the left hip; used crutches for some months. No further trouble until seven years ago, since which time he has had more or less pain, particularly when the joint was wrenched. For the past year pain has been much worse.

Examination. Left hip rotated outward; practically no motion; no sinuses; considerable muscular spasm. Three inches atrophy of thigh.

Case XXVII.—E. W., woman, aged nineteen years. Seen December 19, 1898. Diagnosis: Hip disease. Excision of the hip performed several years ago at the City Hospital. No trouble until a few weeks since, when an indurated mass appeared on the outer side of the right thigh, suggesting suppuration. Referred to house for operation.

Case XXVIII.—M. C., woman, aged twenty-eight years. Seen February 10, 1899. Diagnosis: Pott's disease. Has had a hump in the back since she was three years of age. Has had no trouble since she can remember until the past few weeks, when she has complained of pain referred to the abdomen, particularly at night.

Examination shows marked right-angle deformity in the upper dorsal region. Spine rigid except for muscular spasm below the deformity. Ribs crowded down on the crest of the ilium.

Case XXIX.—J. D., male, aged twenty-one years. Seen February 13, 1899. Diagnosis: Tuberculosis of the innominate.

When a small boy had a discharge from the left femur which ran for a short time and healed up. No breaking out since that time until four years ago, when an abscess appeared in the groin, which was opened and has filled up several times since. Slightly lame occasionally.

Examination shows evidence of disease connected with the sacrum or the left innominate. Discharging sinus in the groin, Referred to the house.

Case XXX.—K. M., woman, aged sixteen years. Seen February 24, 1899. Diagnosis: Pott's disease. Disease as an infant; no treatment and no trouble from it until three weeks ago, when tumor appeared over the left hip; increase in size and painful.

Examination shows some shortening of the trunk due to the old lumbar tuberculous disease, causing the ribs to press on the ilium on the right side and to a less degree on the left. Large, tense fluctuating tumor the size of an orange just behind the crest of the left ilium. Repeated suppuration; finally free opening.

Case XXXI.—F. M. D., male, aged sixteen years. Seen April 22, 1899. Diagnosis: Pott's disease. Disease began at sixth year. Paraplegic the whole year; in bed. One year after this paraplegic attack was confined in bed for six months. Four years from the onset of the disease had an abscess, and since then has had pleurisy and been tapped.

Examination. Marked deformity in the upper and mid-dorsal region. Large, rounded curve; exaggerated reflex; no clonus. Poor general condition. Under the use of a spring-back brace and general treatment he improved steadily until December, 1901, at which time the paraplegic symptoms again appeared, and at this date, May, 1902, the patient has been confined to bed with exaggerated reflexes, marked clonus, loss of power and also of sensation below the umbilicus for five months. No elevation of temperature, and nothing to account for the paraplegia in the way of abscess.

Case XXXII.—F. A. H., male, aged forty-one years. Seen with Dr. Brewster. Diagnosis: Hip disease. Thirty years ago had hip disease with abscess, which healed. Then the patient was in good health and worked steadily without interruption until one and a half years ago, when his hip was excised for acute trouble and showed evidence of lighting up of the active process at the seat of the old disease.

Case XXXIII.—H. H., woman, aged thirty-five years. Diagnosis: Tumor albus. Duration, since nine years of age. Has worn splint at two or three different times; once at the age of fourteen years, on account of spontaneous fracture at the seat of the old disease. Abscess appeared in 1899 for the first time, and has discharged intermittently since.

Case XXXIV.—A. F., woman, aged twenty-eight years. Seen June 9, 1899. Diagnosis: Pott's disease. Duration, since five years of age. No apparatus. Well until two months ago, when abscess appeared. Large kyphos, involving one-half the dorsal spine.

Case XXXV.—W. B., man, aged thirty-five years. Seen June 16, 1899. Diagnosis: Hip disease. Since five years of age. No adequate treatment. Discharging sinuses for past five years. Right-angle flexion of right hip ankylosed.

Case XXXVI.—A. T. K., male, aged twenty-eight years. Seen June 12, 1900. Diagnosis: Tumor albus. Duration, seven-

teen years. Quiescent until four weeks ago, when fall made it acute. Suppurating in two places. No apparatus or other efficient treatment.

Case XXXVII.—N. M., female, aged twenty-two years. Seen June 20, 1900. Diagnosis: Hip disease. Fell from a tree as a small child, and on crutches three years. Entirely well, except for lameness, since then, until six months ago, when abscess formed. Excision, and is now going to pieces with general tuberculosis.

Case XXXVIII.—K. G., female, aged twenty-two years. Diagnosis: Hip disease. Disease began twelve years ago, and was treated at the Boston City Hospital, and hip finally excised. Well after that until two years ago. Pain and abscess.

Case XXXIX.—C. K., female, aged twenty-one years. Tuberculosis of wrist at seven years of age. Tuberculosis of ankle at eight years of age; operated. Hip disease at fourteen years of age; pain for a while and lameness, but no treatment, and about as usual. Abscess one year ago. Excision in 1900, with excellent result.

Case XL.—E. A., male, aged twenty-four years. Seen March 15, 1901. Diagnosis: Tumor albus. As a child had superficial tubercular lesions on the bones of the right wrist, which have left several old healed cicatrices. Two years ago first noticed swelling of the left knee, which was excised for extensive suppuration in May, 1901. The patient progressively became worse, and general tuberculosis resulted. Thigh was amputated, with temporary arrest of symptoms, but the patient died within a year of pulmonary tuberculosis.

Case XLI.—J. P., female, aged seventeen years. Seen March 18, 1901. Diagnosis: Tumor albus. Treated ten years ago at the Children's Hospital for tumor albus, from which he apparently recovered. Nine months ago fell, injuring the right knee, and was in the City Hospital, where a splint was applied, which

she has worn ever since. Operated and partial excision in November, 1901, and diseased bone removed, since which time she has progressively improved locally and constitutionally.

Case XLII.—J. J., male, aged sixteen years. Seen July 17, 1901. Diagnosis: Tumor albus. Nine years ago had trouble with the right knee, swelling without pain; caused only temporary lameness, swelling lasting six months. No trouble from that time until nine months ago, when the leg began to contract and swelling returned, and has been very lame and had much pain.

Examination showed typical appearance of acute tumor albus, confirmed by the X-ray. Partial excision August 23, 1901, with apparent complete removal of the disease. No signs of recurrence at this date, May 20, 1902.

Case XLIII.—J. S. B., male, aged thirty-one years. Seen August 30, 1901. Diagnosis: Pott's disease. When seven years of age injured back, and during the succeeding year marked knuckle developed, for which he was treated for six years at the Children's Hospital, at the end of which time he was regarded as well, except for the deformity. He has worked steadily ever since until two months ago, when he noticed a swelling in the right lumbar region. This has progressively increased in size until at entrance it was a large, fluctuating abscess, for which he was admitted to the house and the abscess drained. Patient died of pulmonary embolus two weeks after the operation.

Case XLIV.—M. M., female, aged twenty-five years. Seen September 16, 1901. Diagnosis: Tumor albus. Eight years ago right knee was swollen and tender, and has always been somewhat stiff and slightly swollen since that time, although there have been no acute symptoms. Considered herself well up to two months ago, at which time the knee became more swollen and very painful and somewhat contracted.

X-ray as well as physical examination showed evidence of tuberculous disease of the femur and the patella. Excision of the knee performed in December with satisfactory results.

Case XLV.—F. C., female, aged twenty years. Seen October 23, 1901. Diagnosis: Tuberculosis of the shoulder. Injured right shoulder when a child; said to have been dislocated. Occasionally has had some trouble with it since that time. Three days before entrance she noticed pain and swelling and inability to use the right shoulder-joint.

On examination there were evidences of acute trouble in the shoulder, for which operation was advised, and a tuberculous focus eradicated from the tuberosity of the humerus. Patient had hip disease when she was three years of age, but this now gives her no trouble. At the present time also has signs of phthisis in the right chest. Has done well since the partial shoulder excision.

Case XLVI.—J. H. A., male, aged twenty-seven years. Seen May 20, 1902. Diagnosis: Pott's disease. Pott's disease at six months of age. Wore apparatus intermittently until he was eighteen years of age. Always worked on farm, and though "hired out as a boy he did a man's work." Owns and operates a farm alone now. Tipped out of sleigh in February, 1902, and struck on shoulder and back. Since then has been in bed a good deal of the time. About two or three weeks ago first noticed abscess, which has steadily increased. Some numbness in legs, particularly the right. General health very good. Paralysis thirteen years ago in both legs; laid up for some months. Lumbar abscess of large size.

INFANTILE PARALYSIS. AN EPIDEMIC OF THIRTY-EIGHT CASES.

By CHARLES F. PAINTER, M.D.,
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These cases occurred in Gloucester, Mass., in the summer of 1900. They were noted, in point of time, from the latter part of June to the first part of September. In point of space they were within a radius of four miles, at the very extreme limit, and most of them were in a comparatively narrow compass. My purpose in reporting them is to put on record one more series of cases, and it is one of the largest, which goes to show the possible infectious and epidemic character of this disease.

For a moment let us see what the present feeling is as regards the epidemic and infectious character of this disease as shown in the text-books of medicine. One naturally looks to the neurological and pediatric books. Holt, in his 1897 edition, makes no mention of the epidemics, but states that it is his belief that recent autopsies prove the inflammatory character of the disease.

The article in Keating's *Encyclopedia*, written by Sinkler, refers to the Lyons epidemic, but is not prepared to accept Cordier's conclusions regarding the epidemic character of infantile paralysis. This was written in 1890.

In Pepper's *System* the article on Infantile Paralysis was written by Dr. Mary Jacobi, who makes no reference to epidemics.

Rotch in his last edition says, "It occurs in epidemics and is, therefore, supposed to be infectious in its origin, but no specific organism has been discovered."

Dr. P. Marie, in his lectures on Infantile Paralysis, cites the foreign epidemics as the most conclusive proof of the infectious

character of the disease, and states that he had contended for some years, from a study of the autopsy reports, that such would eventually be proven.

Dana, in the fifth edition of *Diseases of the Nervous System* (1901), says that 80 per cent. of the cases occur between June and September, and that it frequently follows in the wake of measles and other acute infectious diseases. He attributes to over-exercise and chilling of the body the chief etiological factors. He makes no reference to the epidemic form.

Collins, in his *Treatment of Diseases of the Nervous System*, published in 1900, does not refer to the epidemics, though he says it may occur either sporadically or epidemically.

Oppenheim, in his *Diseases of the Nervous System*, says that cold, trauma, and infection are concerned in the etiology, but makes no special reference to the bearing of epidemics upon the probable character of the disease.

Henriques and Hallian have produced the same lesions in the anterior horns of animals by means of infectious organisms that have been observed and described by Cornil, Prevost, and Vulpius, Charcot and Joffroy, and more recently by Goldschreider (in the *Zeitschrift für klin. Med.*, 1892), and by Seimerling (in the *Archiv für Psychiatry*, January, 1894), as being characteristic of anterior poliomyelitis. They also observed the same lesions in a case of chronic sulphonal poisoning.

The principal epidemics reported are the following:

Colmer (*American Journal of the Medical Sciences*, 1843) reports an epidemic of "teething paralysis" (eight to ten cases) occurring in a radius of three miles, in a period of time covering three months. This was in West Feliciana, La. The cases were apparently typical cases of anterior poliomyelitis.

Bergenholtz in Umea, Sweden, observed a group of 13 cases in one and a half months. This occurred in 1881.

Oxholm, in Mendal, Norway, reported at about the same time 9 cases in a small community in an interval of six weeks.

Medin, in 1887, witnessed and has carefully reported an epidemic occurring in Stockholm. There were 44 cases and 3 deaths. The epidemic lasted from August 9 to September 23, 1887.

Cordier reported the occurrence of a group of 13 cases in the neighborhood of Lyons, France, in 1885, observed in June and July of that year.

Caverly reported a large epidemic occurring in Vermont in the valley of the Otter River. In the number of cases reported it exceeds all others on record, as there were 126, with a mortality of 18. This epidemic has been carefully reviewed by a number of neurologists, and all are not agreed as to its being a *bona fide* uncomplicated infantile epidemic. The mortailty was extraordinarily high, and there were some features which suggested the epidemic cerebro-spinal meningitis.

A small epidemic of undoubted cases occurred in Cherryfield, Maine, and has been reported. There were 8 or 10 cases involved, without mortality.

Brackett reported an epidemic of about the same size occurring in North Adams, Mass., in about 1896.

Leo Newmark, of San Francisco, reports a small group of 5 cases in a population of forty-nine, in the San Joaquin Valley, in California. This occurred in 1899.

E. Berglieb, in his Inaugural Dissertation at Jena, in 1890, reports 5 cases in epidemic form.

Poughkeepsie epidemic in 1901. This was quite a large epidemic, occurring in the summer of 1901, and was brought to my attention by Dr. H. L. Taylor.

Gloucester is a city of about 25,000 inhabitants, a considerable number of whose citizens are engaged in fishing or in caring for and curing the fish when landed at the wharves. The town is situated on Cape Ann and is virtually surrounded by water, for the ocean bounds it on one side, the harbor of Gloucester on another, and the Annisquam River and its branches connect these two bodies of water on a third side, thus forming a triangle. Parts of it are fairly high, and solid rock underlies practically the whole of it, and so near the surface of the soil is this that trenching for water or sewer purposes is attended with the utmost difficulty. In fact, sewers have never been attempted in the city on this account, and in consequence nearly every house has instead a cesspool in its own yard.

In spite of these, to say the least, not wholly ideal hygienic

conditions, the published reports of the Board of Health show that the death-rate of the city is low, leaving out the deaths of its inhabitants at sea. Diseases of an infectious character are not conspicuously prevalent. The death-rate for the year of 1900 was higher than that for five years previous, and this could not have been due to this epidemic, as there is only one death reported as the result of that. There were a few cases (2 in all) of death from cerebro-spinal meningitis during the two months this disease (anterior poliomyelitis) was prevalent. These were sporadic cases. There are no official meteorological measurements made in the city, but through the kindness of the secretary of the Board of Health I have been able to secure the records kept by him from June 15th to September 15th of this year. An investigation of the sources from which the families in which these cases occurred procured their milk, ice, and meat revealed the fact that all three of these articles were secured indiscriminately at one place or another, and that in no possible way could they be regarded as playing any part in the etiology.

City of Gloucester.—Temperatures 1900.

			Maximum.	*Minimum.*
Friday,	June	15	79°	62°
Saturday,	"	16	83	57
Sunday,	"	17	74	62
Monday,	"	18	64	57
Tuesday,	"	19	64	52
Wednesday,	"	20	76	58
Thursday,	"	21	82	62
Friday,	"	22	87	66
Saturday,	"	23	74	54
Sunday,	"	24	82	56
Monday,	"	25	87	69
Tuesday,	"	26	82	60
Wednesday,	"	27	94	64
Thursday,	"	28	88	74
Friday,	"	29	84	68
Saturday,	"	30	..	..
Sunday,	July	1	73	55
Monday,	"	2	75	56
Tuesday,	"	3	77	66
Wednesday,	"	4	87	63
Thursday,	"	5	78	64
Friday,	"	6	71	62

			Maximum.	*Minimum.*
Saturday,	July	7	95°	62°
Sunday,	"	8	82	71
Monday,	"	9	82	70
Tuesday,	"	10	80	61
Wednesday,	"	11	87	63
Thursday,	"	12	84	68
Friday,	"	13	80	62
Saturday,	"	14	81	64
Sunday,	"	15	82	64
Monday,	"	16	95	73
Tuesday,	"	17	95	78
Wednesday,	"	18	97	74
Thursday,	"	19	87	64
Friday,	"	20	71	63
Saturday,	"	21	81	66
Sunday,	"	22	72	62
Monday,	"	23	89	64
Tuesday,	"	24	87	71
Wednesday,	"	25	86	70
Thursday,	"	26	68	63
Friday,	"	27	74	63
Saturday,	"	28	81	60
Sunday,	"	29	86	65
Monday,	"	30	81	66
Tuesday,	"	31	87	66
Wednesday,	August	1	81	70
Thursday,	"	2	81	58
Friday,	"	3	76	60
Saturday,	"	4	73	55
Sunday,	"	5	73	58
Monday,	"	6	92	64
Tuesday,	"	7	75	66
Wednesday,	"	8	73	63
Thursday,	"	9	86	68
Friday,	"	10	93	71
Saturday,	"	11	98	78
Sunday,	"	12	70	59
Monday,	"	13	66	61
Tuesday,	"	14	63	56
Wednesday,	"	15	75	60
Thursday,	"	16	74	62
Friday,	"	17	84	62
Saturday,	"	18	..	..
Sunday,	"	19	74	61
Monday,	"	20	66	55
Tuesday,	"	21	71	59
Wednesday,	"	22	78	60
Thursday,	"	23	75	60
Friday,	"	24	..	..

			Maximum.	*Minimum.*
Saturday,	August	25	74°	92°
Sunday,	"	26	74	92
Monday,	"	27	87	77
Tuesday,	"	28	76	60
Wednesday,	"	29	74	66
Thursday,	"	30	88	66
Friday,	"	31	73	67

The following is the report of the cases occurring in this epidemic, most of which were personally seen by the writer. A few cases it was impossible to see, but in these cases the family or attending physician has kindly given the information used.

Case I.—E. H., aged five years. July 13, 1900. Seen with Dr. T. Conant. Child was perfectly well up to the day that he was taken sick with infantile paralysis. He was taken with an attack of fever, followed by convulsions, coma, and vomiting, the latter continuing for three days. Paralysis was complete of both upper and lower extremities. Both sphincters were paralyzed at the outset, and even now (September, 1901) there is some urinary incontinence. There were convulsive motions of the face and of the arms during the coma. Temperature reached 104°.

General Remarks. The child seemed to have some pain, particulary when moved. Wanted to be rubbed all the time. The house is situated high and the family live on the second floor. The weather was extremely hot, and this case was regarded as one of heat prostration until the paralysis became notable. City water is used and the sewage is received in a cesspool in the yard. This child has since died of complications following pertussis.

Examination.[1] Flaccid paralysis of trunk muscles, both arms, and legs. Contraction of hamstrings and tendo Achilles. Subluxation of both tibiæ. Arms rotated inward. Can use fingers. By resting elbows on the table can get hand to head. Can flex but cannot extend the legs. Short rotators of the thigh are present. Knee reflexes absent, and no plantar reflex. Cerebration clear.

[1] All examinations refer to those made in September, 1901.

Case II.—D. H., boy, aged two years and six months. Seen with Dr. Thomas Conant. The child was perfectly well up to July 7, 1900. Was playing about out-doors all the afternoon of that day. Went to bed as usual, and had a chill, causing him to wake up screaming with pain referred to his stomach. Next day the parents noticed that the child was "limp in his back" and that the right arm was useless. At the outset there was also a slight ptosis of the right eye which quickly cleared up. Has had incontinence since. Legs were not paralyzed. In bed two months.

Examination. A strong, healthy boy. Both legs and the spine now all right. The right arm partially paralyzed, especially the upper arm and the shoulder muscles. The arm is flaccid; grip stronger in the left hand. By resting the elbow he can reach the hand to the head and feed himself. Marked atrophy of the arm and the forearm. No scoliosis. Improvement has been slow but constant under the use of massage. At the onset there was considerable pain and numbness referred to the arm.

The house is situated on a high street and on high ground. City water supply is used, and cesspool in the back yard about twenty feet from the house affords the drainage.

Case III.—M. C. K., girl, aged six and a half years. Seen with Dr. Conant. Had always been a very nervous child, having had chorea the previous winter. Was perfectly well up to July 24, 1900, when she was taken ill during the night. On getting up in the morning she told her parents that she was "dizzy in the legs." The previous evening she had been wading in the ocean. The "dizziness" increased, so that by noon she was scarcely able to walk. During that night she had frequent severe attacks of pain and slight convulsions. Both legs were paralyzed. No involvement of the arms. Sphincters not involved. Considerable fever. No vomiting. She was in bed three weeks.

Examination. Pale, fairly developed child. Flaccid paralysis of both legs, particularly the anterior tibial group; plantar reflex nearly normal. The left foot has kept the most power. Reflexes absent at the knees. Can walk with the aid of mother's

hand steadying her. Extensors of the thighs also partially paralyzed. Some contraction of both tendo Achilles. The spine not affected. Hygienic surroundings of the house good. City water; cesspool.

Case IV.—R. P., girl, aged six years. Seen with Dr. Quimby. Perfectly well until July 6, 1900. Child came down stairs to be dressed, and could not stand after she was dressed. Both legs and spine completely paralyzed for about two weeks. In three months the left leg had entirely recovered. The right remains as at present. Vomiting and fever; considerable pain on motion, and delirium.

Examination. Right leg flaccid and atrophied. Paralysis confined to the anterior groups of the leg and to the quadriceps extensor. Incontinence since the disease, never before. Used to be a phlegmatic child; is now very nervous. Double tenement-house; poor and dirty surroundings, on fairly high ground with good air space about. City water and cesspool.

Case V.—M. W., girl, aged five years. Seen with Dr. A. S. Garland. Child was taken sick August 28, 1900. Had never been sick before. Was perfectly well in the morning on getting up. Complained of pain in the head without vomiting. Fever 103°. Paralysis of both legs, especially the right, and slightly of the right arm, this coming on the day following the onset of febrile symptoms. Arm cleared up entirely in a few days. Child was feverish and drowsy for a week. Left leg has almost entirely cleared up. Pain disappeared after the first day. No convulsions. Some paralysis of the right lower leg. No power either of flexion or extension of the foot. No power to extend the leg; atrophy; flaccid paralysis. Has improved gradually, so that the child walks with a cane or crutch. Some incontinence since, none before. More nervous since the disease.

Case VI.—E. B., girl, aged three years. Perfectly well until June 30, 1900, when she was suddenly taken while at play with a severe headache. Went to sleep and slept all the afternoon, and continued this way for three days. Very feverish; no vom-

iting. Head was very hot and child was stupid. On the fourth day complete paralysis of both arms, legs, and back was noticed. Can use both hands, but cannot raise them above the head. The right leg has improved the most. Can now stand by holding on to the table and hitch herself along. Poor hygienic surroundings; tenement-house; low grounds. Water from well; no sewer connection. Four children in cramped quarters and poor circumstances.

Case VII.—H. P., a boy, aged one and a half years. Seen with Dr. Quimby. Perfectly well until June 30, 1900, when he was taken, while playing in the wet weeds in the hot sun, with pain in his head and vomiting. Was sleepy and stupid for three or four days; no convulsions; could not stand; feet and knees swollen; back was so weak he could not hold his head up; a great deal of pain on being handled. Very feverish and "red as a beet." No sphincteric involvement. Both legs involved but not the arms. It was nearly two months before he could sit up. Walked in October, 1900. No improvement since then.

Examination. Flexion of great toe is possible, but not of the others. Stands with feet rolled outward and marked toe-drop. No power in the quadriceps extensors. Knee-jerks absent. Marked valgus. Atrophy; flaccid paralysis. Basement tenement on a rocky hillside. City water and no sewer. Surroundings clean, and general hygiene apparently good.

Case VIII.—F. S., a boy, aged three years. Seen with Dr. Quimby. Child was perfectly well until July 10, 1900. His mother took him down to play in the sand in the afternoon. Went to bed for a nap, and on waking he was very feverish; pain in the head; delirious for about a week, without convulsions; vomited for several days. Sleepy and stupid for a considerable time. Could not sit up. Both legs also paralyzed. Arms all right. Some incontinence. Has improved gradually, and particularly in the last month, August, 1901.

Examination. Left leg markedly flabby and atrophied; also thigh. Foot held in position of valgus. Anterior tibial muscles chiefly affected; common extensors pulling foot into position of

valgus. Knee-jerks on the left absent. Thigh muscles not involved. Family live in an up-stairs tenement near ocean in good hygienic surroundings. City water; no sewer.

Case IX.—J. J., boy, aged thirteen months. Perfectly well until July 12, 1900. Went to bed feeling all right. Woke up vomiting, with fever, but this was not paid much attention to, until a week later it was noticed that the left leg could not be used as well as formerly. Had some pain in the back at the outset. (The child's parents are dead and the history obtained was from a neighbor.)

Examination. Both legs involved at the outset; the right has largely cleared up. Reflexes absent. Marked valgus in both legs, especially the left, which is half an inch atrophied. Paralysis of the flaccid type. Cannot dorsally flex the left foot. Toe-drop. Hygienic surroundings not very good. City water; cesspool.

Case X.—C. W. N., boy, aged three and one-quarter years. Seen with Dr. Mooney. When the child's mother left home at noon, July 15th, the child was perfectly well. Returned at two o'clock and found him asleep. He awakened slightly feverish and complaining of headache. Took him for a car-ride, and was gone two hours. On putting him on the car to return his legs gave out from under him, and he could not stand. Sick for two weeks, with considerable fever for the first three days. Sleepy and stupid for a whole week. Pain on being moved. No incontinence. Has improved very much, and still continues to do so.

Examination. Right leg shows flaccid paralysis; three-quarters of an inch atrophy; absent knee-jerks. Arms and left leg all right. Can dorsally flex the foot in the straight position, and can extend it also, but both motions are much less strong than in the left leg. No deformity. Walks with a slight limp. Ground floor; house on high ground. City water; cesspool. Poor hygienic surroundings.

Case XI.—M. G. B., girl, aged two and a half years. Seen with Dr. Mooney. On July 15, 1900, got up as well as usual.

At breakfast vomited and went to bed with headache. In bed for three days with considerable fever. Broke out all over with an eruption, which from the description tallies with urticaria, which lasted one day. The weather was very hot, and the child had been playing in the sun the previous day. The right arm and the right leg were involved in the paralysis. For five weeks she could not raise the arm or leg. Improved gradually.

Examination. Right leg in the position of valgus. Flaccid paralysis. One inch atrophy of thigh; one-half inch atrophy of calf. Anterior tibial muscles weak, and the common extensor pull the foot into a valgus position. Fair power in the posterior groups. Seven children; in good circumstances. Cesspool in the yard thirty feet from house. City water.

Case XII.—R. R., boy, aged ten years. Seen with Dr. Proctor. Acute attack took place on September 4, 1900. Child lives next door to Case V., which was taken sick on August 28, 1900. Had been perfectly well until this time. Was a strong, well-developed boy. Complained of severe headache, vomiting, and a fever which reached 101°. Was in bed two or three days before any paralysis was noticed, and then it involved all four extremities. After a few weeks the paralysis of the legs nearly all cleared up, but the arms only partially cleared. Had a great deal of pain all over during the acute stage, especially upon being moved. No sphincteric involvement.

Examination. Marked pigeon breast; sinking in of the intercostal space; round shoulders; atrophy of the shoulder muscles, particularly the supra- and infraspinati, deltoid, and trapezii. Grip in the hands good. No reflexes at the elbows. Knee-jerk absent. Marked flaccid atrophy of the arms. Can stoop and take up things from the floor readily. Can get the left hand to the top of his head unassisted; the right he can put in this position with difficulty. Can get the arms behind him by swinging, but only in such a way that they rest in the lumbar curve. Marked rounded kyphos in upper dorsal region correctable. General hygienic surroundings good.

Case XIII.—C. W. L., boy, aged three and a half years. Seen with Dr. Rowley. This boy was perfectly well until the early

part of July, 1900; the exact date not known. He was playing around out-of-doors and came in complaining of headache, vomiting, and his temperature reached 102° when first seen by the doctor. He was sick for four or five days with fever and considerable pain in the back aggravated by attempts to move. The left leg was early noticed to be useless. The arms were not affected.

Examination. Foot held in position of valgus. One and a half inches atrophy of thigh and calf. Flaccid paralysis, chiefly of the anterior group. Thigh not involved. Reflexes absent in the left leg. Cannot dorsally flex the foot except in valgus position. Had been a very active child, and improvement has been steady. In good general hygienic surroundings, although the house is situated low and near the river. City water is used, and the drainage is into a cesspool twenty feet from the house.

Case XIV.—R. H. M., boy, aged two and a half years. Seen with Dr. Rowley. Child was taken sick while at play, August 11, 1900. Began with vomiting, headache. Sick with fever for ten days, during which time it hurt him to be moved in bed. Muscles in the neck were stiff and head was held retracted. He was very sensitive to slight pressure over the back and legs; sleepy and stupid most of the time; left leg paralyzed.

Examination. Posterior muscles of left leg partially paralyzed. Can dorsally flex the foot in the normal position, but has no power of plantar flexion. Uses the hand to stiffen his knee and to hold the leg extended. Can flex the thigh on the abdomen with the leg flexed, but cannot extend. Marked atrophy of thigh and calf. The right arm, leg, and both arms and spinal muscles not affected. Improvement has been gradual.

Case XV.—F. E., girl, aged seven years and nine months. Seen with Dr. Rowley. On about August 15, 1900, this child was taken sick with headache. No vomiting; pain in the back and neck, with retraction of the head. Temperature, 102°. Movement in bed caused pain. Both legs paralyzed; arms not involved.

Examination. Child walks very well with both feet in position of valgus, particularly the left. Posterior muscles, except the

peroneals, absent on the right. Anterior muscles weak, but sufficiently good to dorsally flex the foot in the normal position. In the left foot the anterior tibials absent, and the common extensors weak but acting and drawing the foot into the valgus position. Thigh muscles not involved; knee-jerks absent; arms and back all right. There has been considerable slow improvement. Family is a large one in rather poor hygienic surroundings, living on ground floor. Use well water; surface drainage.

Case XVI.—J. F. D., boy, aged one year. Seen with Dr. Proctor. On July 10, 1900, this child was seized suddenly with pain and numbness in both arms and both legs. The right leg now the only member involved. At the onset there was considerable fever, headache, and pain in the back and the neck, with retraction of the head.

Examination. Valgus of the right foot. Atrophy of the right thigh and calf. No knee-jerks on the right, though the child is too young to make a very satisfactory examination. Very poor hygienic surroundings and in close proximity to several of the other cases.

Case XVII.—H. B., boy, aged three years. Case of Dr. Egan's. On June 30, 1900, the child, having been perfectly well previously, was seized with fever, which came suddenly and lasted several days. Both legs and the right arm were paralyzed. The arm is now nearly all well; the right leg is better than the left. The onset was accompanied by vomiting; not much pain. Child was sleepy and stupid during the febrile period. Hygienic surroundings were fair.

This and the following two cases (Cases XVIII. and XIX.) were patients of Dr. Egan's, who kindly gave me the notes, but I was unable to see the cases.

Case XVIII.—Boy, aged two years. On July 10, 1900, was suddenly attacked with fever, accompanied by vomiting, which lasted several days, during which time it was noticed that the use of both legs was lost. At the present time there is a flaccid paralysis of both legs; arms not involved, and there has been

practically no improvement. Poor family, living on low ground in a basement in unhygienic surroundings.

Case XIX.—Boy, aged two years. On July 5, 1900, an acute febrile attack came on when the child was entirely well. The second day of the febrile attack there were noted right facial paralysis and paralysis of the right arm. The facial paralysis cleared up in three or four months, and the arm sooner than this even. The case is said to be entirely well.

Case XX.—E. T. G., boy, aged one year and nine months. Seen with Dr. Proctor. On July 20, 1900, the child was seized with an attack of vomiting and fever, lasting for several days; retraction of the head with a good deal of pain referred to the back and head, this being aggravated by movements in bed. In two weeks, when he began to walk, it was noted that he dragged the left foot.

Examination. Well-developed boy, except for flaccid paralysis, to a slight degree, of the left thigh and calf; one-quarter of an inch atrophy, and the left foot held in position of valgus. Walks with foot slightly everted and a trifling limp.

Case XXI.—L. M. P., boy, aged two years and five months. Seen with Dr. Mooney. On June 8, 1900, the child was seized with vomiting, headache, and considerable fever; the head was retracted; the child was very stupid and difficult to arouse. Complained of pain in the back, aggravated by movement. Right leg the only one involved. At the end of five weeks he was able to walk.

Examination. Valgus of the right foot. Too young to make a very satisfactory examination of the muscles. Apparently cannot draw the foot up because of very little power of plantar flexion.

Case XXII.—E. R., female, aged five years. Taken suddenly while at play early in July (exact date not known) with headache, fever, and vomiting. On the fifth day from onset first noticed paralysis of the right lower leg; this has shown some improvement.

Examination. Anterior tibial group of the right leg paralyzed; toe-drop; contracture of tendo Achillis; flaccid atrophy; valgus position of foot. Absent knee-jerk in the right.

Case XXIII.—G. P., boy, aged one year and seven months. Seen with Dr. Everett. Taken sick on July 4, 1900, having been previously entirely well. He had played out-of-doors most of the time; went to bed the night of the 4th, tired out, but perfectly well. Woke up on the 5th feeling sick and stupid. Temperature 102°, and very difficult to keep him awake. On the 6th when he woke in the morning he was not able to move, and did not for six or seven days. Fever ran very high; vomiting and twitching of arms, and both legs completely paralyzed. The arms did not seem to be paralyzed after he got over the twitching stage and out of his stupor. He dragged the left leg a good deal on walking at first, but this has improved to such a degree that he is nearly all well now except for slight weakness of the anterior tibial group, with a tendency to pronation of the foot.

Case XXIV.—E. K., boy, aged ten years. Seen with Dr. A. E. Garland. On August 16, 1900, the family went to a picnic in East Gloucester. It was a very hot day, and during the afternoon a heavy shower came up, after which there was a sudden drop in temperature—as much as 30° or 35° within an hour. That evening he complained of headache and a great deal of pain in the back of the neck and spine, accompanied by fever. He was stupid, and the fever lasted for about ten days or two weeks. When it disappeared he was left with complete paralysis of both legs, both arms, and the trunk. The arms have gradually improved, so that now there is no apparent loss of power. Both legs are now flaccid to a considerable degree, particularly the thighs. Relatively the thighs are atrophied more than the calves. The plantar and dorsal flexions of the foot are possible to a certain degree, but with diminished power. Quadriceps extensors almost completely paralyzed, and the sartorius does not seem to be much developed. The lower trunk muscles are also completely paralyzed, so that on attempt-

ing to sit up there is a marked kyphos at the junction of the low dorsal and lumbar regions, and it is this paralysis which causes him the greatest difficulty. The boy can walk when he gets into an upright position by holding on to someone's hands or pushing a chair. Improvement has been very considerable and quite continuous even during the past six months.

Case XXV.—R. K., aged three years. Seen with Dr. Garland. This patient was a cousin of Case XXIV., and lived on the floor below, and attended the same picnic. Four days after the onset of Case XXIV. this patient started in in exactly the same way, with headache and vomiting and considerable fever, with loss of use of the arms, and he was confined to bed for nearly three weeks. At the end of this time, however, the child could walk, and there was no evidence of any actual paralysis. There is some question as to whether this was an infantile paralysis or whether it might not have been merely a febrile attack. At any rate, at the present time the child is entirely well and shows no evidence of loss of muscular power.

Case XXVI.—E. B., aged three years. Seen with Dr. Evelyth. This case was taken ill on June 19, 1900, and for six days there was considerable fever, temperature being 103°; malaise and general constitutional symptoms. During this time it was noted that the right lower extremity was paralyzed; no other limbs affected. There was atrophy and loss of power in the anterior tibial group. Walks with slight limp, some toe-drop, and a tendency to valgus. Three-quarters of an inch atrophy of the calf. The child lives in good hygienic surroundings, the house being situated high, with good drainage and the city water.

Dr. Evelyth saw in all five cases besides the one just described. All the others were in poor families where it is now impossible to trace the cases. They all, however, presented the typical symptoms of an acute infantile paralysis. They all did fairly well, that is, they gradually improved for a considerable period after the original paralysis. They were all young children. They started in with fever, malaise, and vomiting, followed by paralysis, the paralysis being confined in all cases

to one of the lower extremities, with a single exception. In this case one arm was the only extremity affected. There were no deaths, and there were no cases in which cerebro-spinal complications were suggested. Improvement has been gradual and up to a certain point only in all cases observed.

Case XXVII.—Girl, aged six months. Seen with Dr. Quimby. At birth the child had a congenital absence of the left femur and a contracture of the index and ring fingers of the left hand. Otherwise was healthy and normal, except for an obstetrical paralysis of the right arm. Six months after birth, or about the middle of July, 1900, the exact date could not be obtained, this child was affected with infantile paralysis, starting in with fever, vomiting, malaise, constant rolling of the head from side to side, followed in a day or two by complete paralysis, of the flaccid type, involving the right thigh and leg and the left arm. There had been practically no improvement in this case since the onset. The left arm and forearm seemed to be completely paralyzed; slight ability to flex or extend the fingers. The only power in the right leg is in the anterior tibial group, which enables her to draw up the foot.

Case XXVIII.—C. C., aged two years and three months. Seen with Dr. Hallett. On July 4, 1900, which was a very hot day, this child was taken while at play in the street. The first symptom noted was falling while in the street and inability to support himself afterward. He went into the house, and was very stupid all day, and the next day was so feverish that a physician was called. The child seemed very stupid and almost unconscious; rolled his eyes from side to side and complained when moved, but constantly wished to be taken up and held, though he as constantly wished to be immediately put down. There has been a good deal of improvement, so that now the child is able to stand by holding on to the chairs, but cannot walk.

Examination shows a flaccid paralysis of both legs with considerable atrophy; inability to dorsally flex the feet or to extend the legs. The arms were not affected.

CASE XXX.—E. F., girl, aged two and a half years. On June 30, 1900, the child, who had been previously perfectly well, went to bed complaining of severe pain in the back and soreness of the muscles. Some fever, but the condition was regarded simply as a cold by the parents. The next day it was noted that the child could not move the right arm. She was delirious and rolled her head from side to side a great deal, with some tendency to retraction of the neck.

Examination shows marked atrophy of the right arm and paralysis of the shoulder muscles, so that the child cannot raise the arm straight above the head. Marked atrophy and loss of power in the ability to grip with the hand as well as in the arm and forearm.

CASE XXXI.—R. C. H., boy, aged two and a half years. Seen with Dr. Hallett. Child was perfectly well until June 23, 1900, when he began to complain in the evening of dizziness and headache, followed by vomiting and accompanied by a high fever. Two days later the right leg gave out entirely. No other limbs involved. The child was very nervous and irritable during this time. Muscles of back and leg seemed very stiff. Did not have much pain or soreness in the spine.

Examination shows that the boy walks with a slight eversion of the foot and a slight limp in the right foot. Atrophy of a quarter of an inch of the calf; all muscular action present but slightly weakened as compared with the other foot. The atrophy is more apparent to touch than to sight.

CASE XXXII.—E. G., boy, aged one year and nine months. Seen with Dr. Hallett. This case began the first week in July, 1900, the exact date not known. The child started in with fever, vomiting, and was very stupid and feverish for three or four days; retraction of the head for about a week. Upon motion, especially when sitting up, liked to be rubbed. The paralysis was general, involving both legs and both arms. The left leg was the worst, although the right was considerably affected. Did not walk for five months, and has had to learn over again. The improvement has been gradual, and all that

has been noted wrong with him this summer (1901) is that he has a tendency to trip and fall a great deal, but this is improving.

Examination shows a quarter of an inch atrophy of the right leg, with quite marked limp. Some pronation of the left foot, but all motions present were weaker than on the other side.

From conversation with the physicians who had the care of these cases I should judge that there were a number of others about whom definite data cannot now be given. Dr. Egan remembers 6 other cases which he says occurred at this same time, but which he cannot give the data concerning. Dr. Rowley saw 12 cases in all, 4 of which are referred to in the report of cases, but the other 8 I was unable to see or get any record of other than as a matter of memory. He definitely recollects, however, that they were seen during July and August, and presented the same general symptoms, with the resulting permanent paralysis which had generally considerably improved. One other case also occurred which was attended by Dr. Mosher, in Lanesville, which is not included in this list on account of lack of data. This case was mentioned to me by Dr. Rowley.

One other case seen by Dr. Rowley which presented certain complications is also not included in this list on account of the uncertainty of diagnosis. This was a case which started in with the same general symptoms at the same time as these other cases, in a young child, presenting paralysis of the lower limbs which has slowly improved, but accompanied by a severe infection causing purpura and an acute nephritis, with effusion in the chest.

In this epidemic there has been only one death which was observed by Dr. Garland, and was regarded by all those who saw the case as undoubtedly one of infantile paralysis. It occurred in the midst of this epidemic, presenting characteristic infantile symptoms with lower-leg paralysis. Three days later definite cerebral symptoms came on, and the child died in thirty-six hours of what seemed to be cerebro-spinal meningitis.

The local physicians had attributed the epidemic generally to the great changes in temperature which occurred at that period.

I desire to make acknowledgment of the courtesy shown me

by the profession in Gloucester in enabling me to examine these cases, so far as they could be found and for data supplied in cases where the patients could not be interviewed.

It will be difficult, I think, to draw any conclusion from this report as to the special etiological factor in this epidemic. All the local conditions which were investigated in this connection, I think, must be passed over as being in themselves of no consequence. They may in some way which is not now clear have acted as contributing causative factors; the great similarity in the symptom complex as seen through all the cases and their resemblance to symptoms long recognized as indicative of infections seem to me to afford as good evidence of the infectiousness of anterior poliomyelitis as we have in the case of scarlet fever, for example, about which no one now entertains any doubt. The absence of an autopsy on the only case of death in this group is much to be regretted, but had it been obtained and an organism found, we might not be in a position to know what was its manner of entrance. It seems to me probable that there may be several organisms capable of producing this symptom complex. Given the proper conditions present in the individual and that of all the contributive factors which prepare the way for the entrance of a bacterium or a coccus to the anterior horns of the cord, perhaps the one to be most reckoned with is the exposure to temperature changes through the vasomotor system; it will be noted that the majority of cases occurred on or more frequently twenty-four to thirty-six hours after periods of extreme heat, and in some cases, as in Cases XXIV. and XXV., after a sudden and sharp drop from an abnormally high temperature; in other cases they followed bathing in the ocean.

In conclusion, the following statistics from this epidemic may be of interest. There were twenty-three males and nine females; the youngest was thirteen months, the oldest ten years of age. 21 were three years or younger; 8 were two years or younger; 7 were four years or over. No cases observed got entirely well, and only 1, as before stated, died, though this one was not included among the 38 reported.

ROTATION IN LATERAL CURVATURE.

A REPLY TO DR. JUDSON.

By ROBERT W. LOVETT, M.D.,
BOSTON.

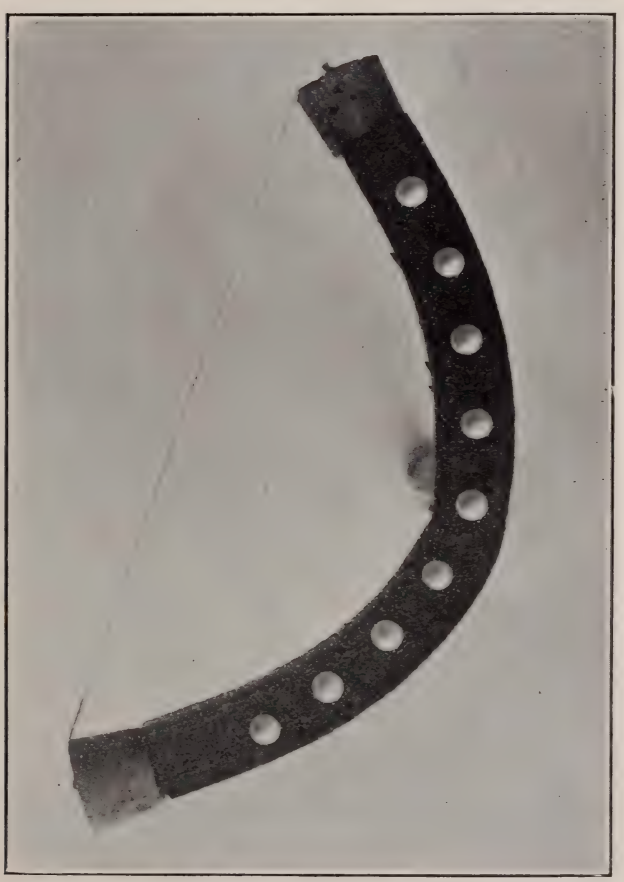
In a paper on "The Mechanics of Lateral Curvature," published in 1900,[1] I called attention to the necessary association of rotation of the vertebræ with side bendings of the spine, and went on further to show "that lateral flexion and torsion of the spine are associated parts of one compound movement, and that neither can exist without the other. That in side bending from the flexed position the torsion is diametrically opposite from what it is in the extended position, and that the spine follows the laws governing flexible rods in this regard." The reason for this rests on mechanical grounds.

"From the mechanical point of view, torsion results from any motion in which all the particles of a straight flexible rod do not move in parallel planes. Consequently, if such a rod is bent in two planes at the same time, torsion must inevitably occur. The vertebral column is not a straight flexible rod, but one bent in the antero-posterior plane by a series of gentle curves; side bending must, therefore, inevitably lead to torsion, because it means bending in two planes. . . . From a mechanical point of view the torsion begins with the beginning of the side bending. It therefore seems very unlikely that pure lateral flexion of the spine ever exists.

[1] Boston Medical and Surgical Journal, June 14, 1900; Transactions of the American Orthopedic Association, vol. xiii. p. 251; cf. Schultben, Zeitschrift f. Orth. Chir., x., 3455.

"A strip of sponge rubber, half an inch in diameter and fourteen inches long, rotates in the same way that the vertebral column does in the same position. It rotates in one direction

FIG. 1.



Strip of rubber held by clamp in middle and bent to right, showing pins in same place.

for side bending when bent forward, and in the opposite direction for side bending when bent backward, and the rotation follows the same rule observed in the vertebral column in the cadaver and in life. A lateral curvature in what corresponds

to the flexed position of the spine may be produced in the rubber strip, following the same rule of rotation seen in life; that is, the front of the rod turns toward the convexity of the

Fig. 2.

Rubber strip bent to right and flexed.

lateral curve. An artificial lateral curvature in the rubber strip, made in what corresponds to the extended position of the spine, results in a reverse rotation to that from the rotation of the flexed position. . . .

"For side bendings, when bent forward, the flexible rod rotates one way, and when bent back and to the same side it rotates the other way. So far as this analogy goes, the spine,

FIG. 3.

Rubber strip bent to right and hyperextended.

therefore, in its rotations does no more than to follow certain laws governing flexible rods."

In the *Journal of the American Medical Association* for February 22, 1902, Dr. A. B. Judson published a photograph of

my experiment, which he asserted showed that rotation of the spine was "unaffected by flexion or extension, a result which might have been expected, *a priori*, because the curve in any

FIG. 4.

Rubber strip seen from one end when flexed and bent to right.

case is but a simple curve and incompetent as such to govern rotation."

As the point is of some importance in connection with the treatment of scoliosis, I have ventured to repeat the experiment,

as photographed by Dr. Judson, for in his photographs it seemed to me that rotation was evident and that they were confirmatory of my experiment, rather than otherwise.

In addition to the positions of the flexible rubber strip that he showed, I have added a lengthwise photograph of the rubber strip bent sidewise, which shows in the different inclinations of the pins that some change in their relation to the antero-posterior axis has occurred, which change is what we mean by rotation. I am indebted to Dr. Percy E. Brown, of Boston, for my photographs, in taking which we followed as closely as we could the condition of Dr. Judson's experiment. The rubber strip was held by a clamp in the middle, and the ends connected by a thread.

In Fig. 1 the rod is shown bent to one side, neither flexed nor extended. In Fig. 2 it is flexed and bent to the right. Taking the middle pin as the fixed point, it may be seen that the sides of the strip have come into view at the end, and that the axis of the pins above and below the centre one is no longer the same as the axis of the centre pin. In Fig. 3 the rod is overextended (to follow the same nomenclature as that employed in the spine, which we are supposed to be seeing from behind) and the pins above and below the centre have again changed in axis and have turned to the *opposite* side from that of Fig. 2. The other side of the end of the rod from that in Fig. 2 has come into view below, demonstrating that the rotation in overextended positions in the rubber strip is the reverse of that in flexed positions. In Fig. 4 one looks along the line of pins, no one of which is in the same antero-posterior plane as the centre pin.

The experiment, therefore, would seem to confirm my original statement that a strip of sponge rubber rotates just as the spine does in the same position, and that in the flexed position it rotates in one way, and in the overextended position in the opposite way.

ACCURATE ANTHROPOMETRIC AND ORTHOPEDIC RECORD BY UNIFORM PHOTOGRAPHIC METHOD.

PRELIMINARY REPORT.

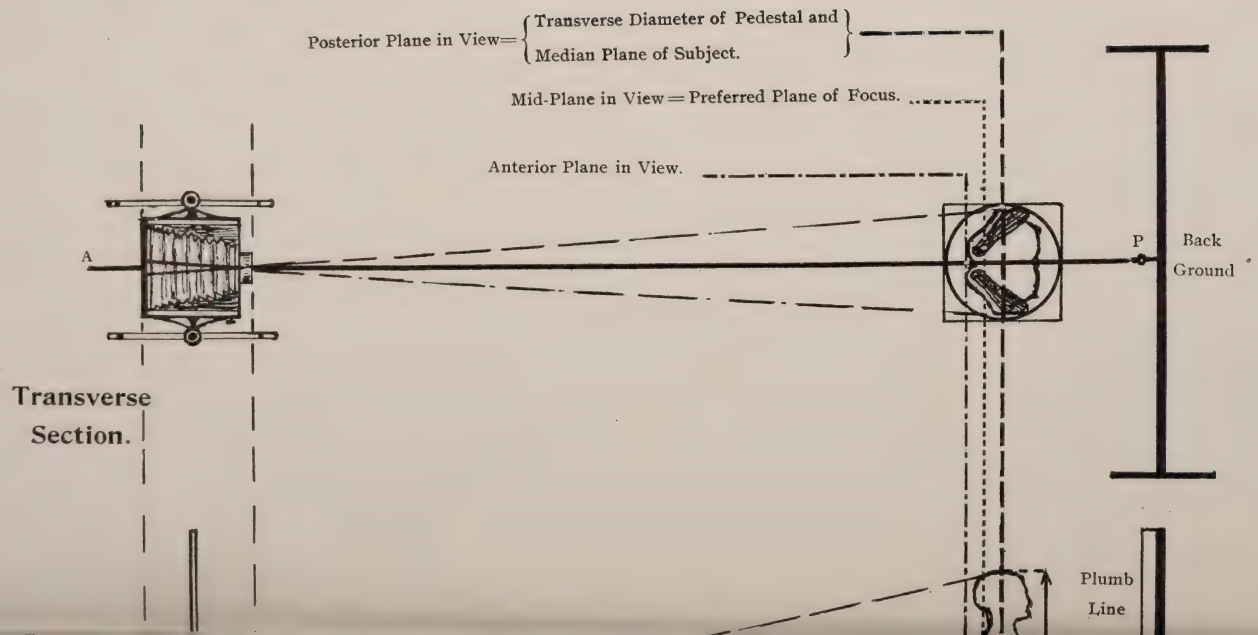
By JOSEPH M. SPELLISSY, M.D.,
PHILADELPHIA.

Photographic records of the same subject are frequently misleading and impossible of accurate comparison, because either intentionally or unintentionally, through ignorance or heedlessness, records are made under conditions so dissimilar as to preclude honest contrast and judgment.

Practically identical conditions are at the command of any amateur or professional who will systematize his work. To the enumeration and illustration of the conditions that must necessarily be uniform in photographic records intended for accurate comparison this paper devotes itself. It has especially in view the recording needs of the treatment of scoliosis and those of the study of anthropometry.

Uniformity of illumination in photographs of the same subject, taken at more or less distant periods of time, is secured by posing the subject in the same spot of the same room and at the same time of day. Disregard of these details results in such diversity of lighting of the subject and modelling in the photographs as to prejudice fair comparison of the latter.

Uniformity of Unavoidable Error. The tendency of the photographic lens to give disproportionate size in its image to those portions of the subject which are in the foreground is known as "distortion." This quality varies with different lenses and according to their focal lengths. The greater the focal length the less should be the distortion.


Posterior Plane in View = { Transverse Diameter of Pedestal and Median Plane of Subject.
Mid-Plane in View = Preferred Plane of Focus.
Anterior Plane in View.
A
P
Back Ground
Transverse Section.
Plumb Line

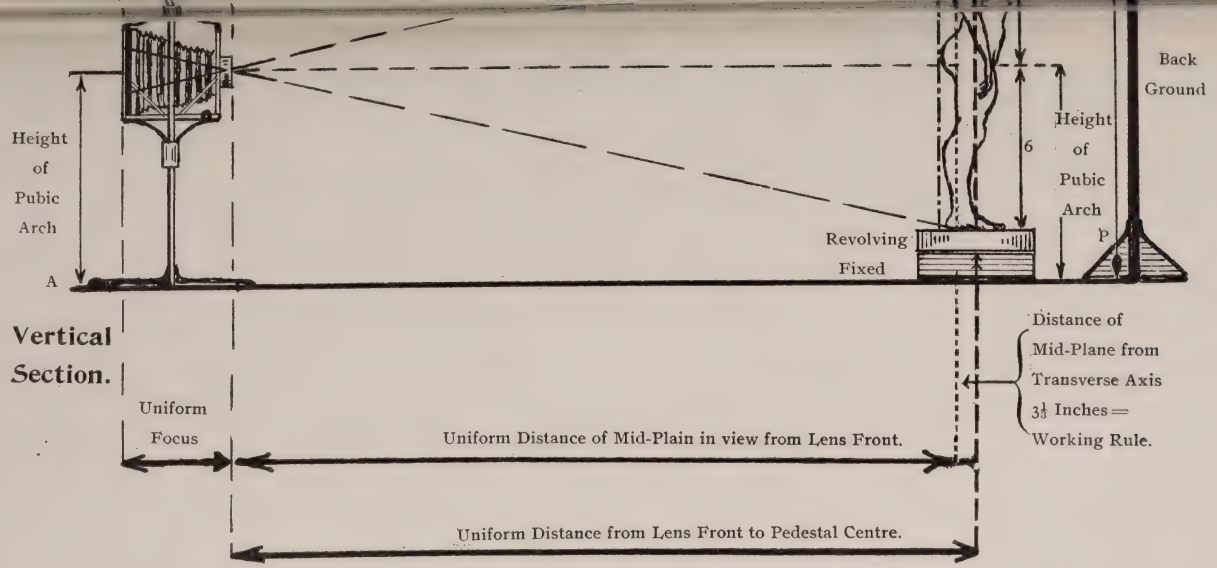


FIG. 1.—Transverse and vertical sections of camera and stand, of subject on revolving stand, of plumb-line, and of background, in illustration that their relations must be fixed to obtain uniformity in photo-records.

Unavoidable distortion can be made uniform by the use of the same lens, at the same focus, and at the same distance from the subject.

"The same focus" can be most accurately obtained by using the same camera with a standard focus marked upon it, and by taking care that the lens front and camera back are at right angles to the bed-plate, which should be horizontal, as shown by spirit levels.

"The same distance" necessitates a camera-stand permitting vertical elevation and depression of the camera in the same vertical plane, and its fixation at any desired height, also a revolving pedestal upon which to pose the subject. The distance between the camera-stand and pedestal should be such as to permit, at least, a full-length view of the largest subject that may be photographed. Six feet two inches is seldom exceeded. Both camera-stand and pedestal should be fixed to the floor, or places should be marked on the floor to secure their accurate replacement when in use. The camera should be screwed to the stand, and they should both be transverse to a line passing through the centres of the camera and the pedestal. To insure accuracy, such a line should be marked on the floor and prolonged behind the pedestal to the background. A plumb-line should be so suspended from the top of this background that the plummet will hang over the line drawn on the floor. The floor-line represents the camera-pedestal or antero-posterior axis; the plumb-line will appear in the negative for purposes of reference as a central and vertical line.

The pedestal consists of a fixed base and an upper revolving portion. The top should be horizontal, and should have drawn on it through its centre of revolution two well-marked lines at right angles to each other. The peripheral extremities of these lines are continuous with vertical lines on the sides of the revolving portion of the pedestal, and are used for truing the antero-posterior and transverse diameters of the revolving top with a vertical line on the non-revolving base. This line joins the antero-posterior axial-line (A P, Fig. 1) marked on the floor. The pedestal base has a catch by which the revolving top can be fixed at will.

The purpose of the revolving top is to permit the subject to be centred both antero-posteriorly and transversely on the pedestal, so that all sides of the subject in the same attitude may be rapidly presented to the camera. It is necessary to centre the subject on the pedestal, so that on revolving it the right and left sides and the front and back of the subjects portrayed may be at the same distance from the lens. Otherwise, distortion results, and views taken of the sides nearer the lens are larger than those which are more distant.

If views taken of the same subject at different times, or views of different subjects, are to be submitted to accurate comparison, they must all be centred on the pedestal by a uniform method. That of the author assumes that subjects should be symmetrical, and he pursues this method with all subjects whether they are symmetrical or not.

To centre the subject vertically the height of the lens centre from the floor is made to correspond with that of the pubic arch of the subject from the floor (Fig. 1), because in the symmetrical subject the centre of height is at the pubic arch.

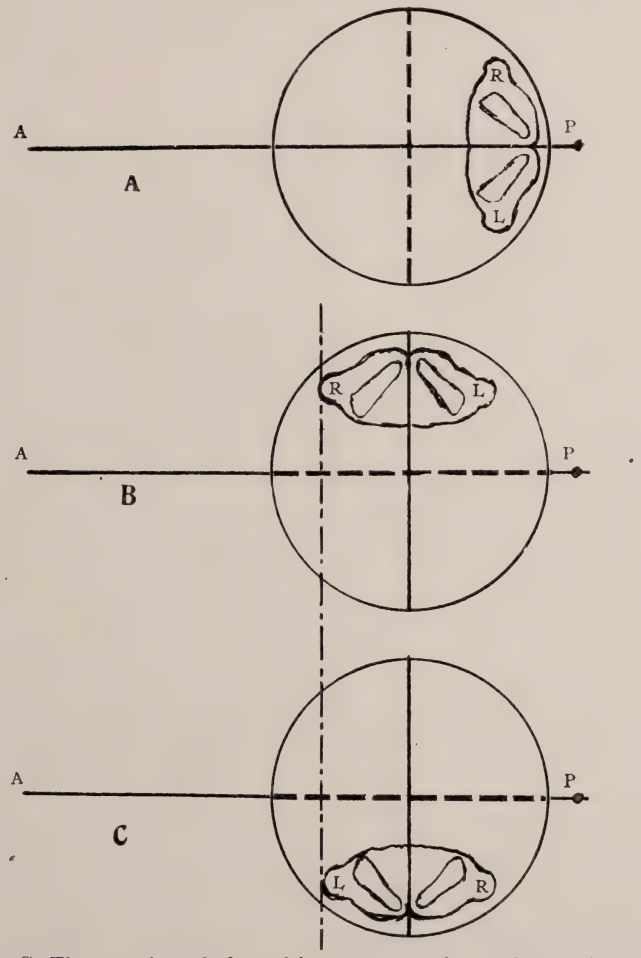
In centring the subject transversely the direction is given to stand with the feet apart and knees back, then to bring the legs together until knees or heels touch. To pose a knock-kneed subject with heels touching is to necessitate the flexion of one knee in front of its fellow, to shorten the length of the limb flexed, and make station asymmetrical. The heels must touch or be equidistant from the antero-posterior diameter, and the axes of the feet must be at a right angle which is bisected by the antero-posterior diameter.

If the subject so standing is symmetrical he is transversely centred on the antero-posterior axis (Fig. 2, A); and on presenting the right (Fig. 2, B) and left (Fig. 2, C) sides to the camera they will be equally distant from it.

To discover the antero-posterior vertical centre of the subject, the author found that on inclosing a number of full-length views of the nude subject between perpendiculars touching the most anterior and posterior portions of the body, that a vertical line drawn midway between these perpendiculars was most frequently coincident with the anterior border of the upper

shin (Fig. 3). Therefore, to centre the patient antero-posteriorly on the transverse axis, turn the revolving pedestal so that its transverse axis is coincident with the line A P, and move

FIG. 2.



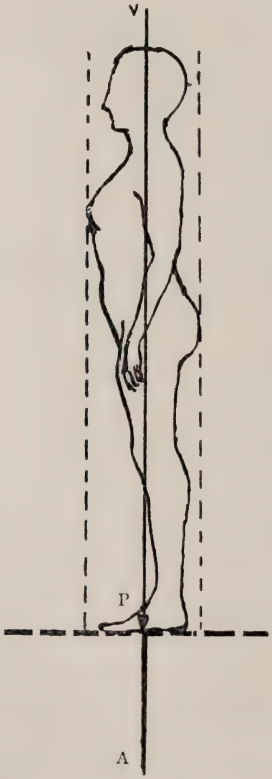
A, B, C. The centring of the subject transversely on the revolving stand.

the subject backward or forward until the image of the anterior line of the shin on the ground glass of the camera coincides with the image of the plumb-line which is the vertical centre.

If the subject so standing is symmetrical he is antero-posteriorly centred on the transverse axis (Fig. 4, A), and on turning the front (Fig. 4, B) or back (Fig. 4, C) to the camera they will be equally distant from it.

Deformed subjects centred on the pedestal in the manner described will suffer photographic distortion in proportion to

FIG. 3.

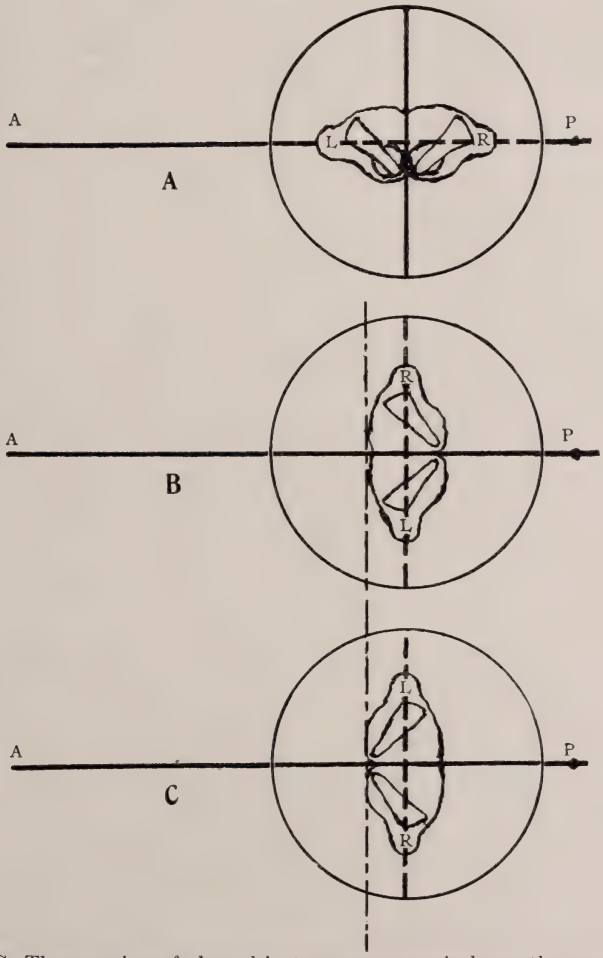


Antero-posterior vertical centre of subject.

their asymmetry, but all subjects of the same degree of asymmetry will suffer the same degree of photographic distortion, and so their photographic records may be accurately compared. If there is rotation of the pelvis or thorax, their transverse axes will not be in line or parallel with the transverse axis of the feet.

Choice of Focused Plane. The photographic image is sharpest in detail for objects in one plane, and only for that plane within

FIG. 4.



A, B, C. The centring of the subject antero-posteriorly on the revolving stand.

limited distances from the centre of the lens. In photographing plane surfaces this is no embarrassment. In photographing an object the surface of which occupies several planes, the plane

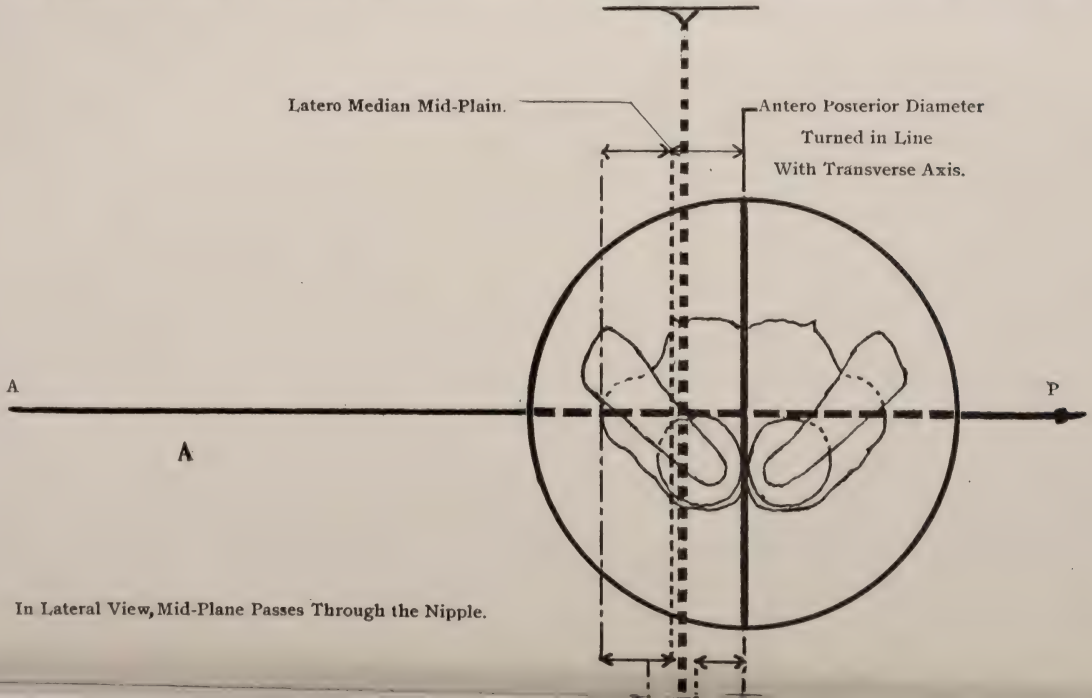
selected for accurate focus should be the mid-plane of the planes in view. The accompanying figures (Fig. 5, A and B) represent cross-sections of the standing subject centred as described above, and presenting, first, the left side (Fig. 5, A) and transverse diameter, and second, the front and antero-posterior diameter (Fig. 5, B) to the camera. In both instances the most posterior plane in view passes through the centre of the subject and of the pedestal, the planes of the right side and of the back not being in view. The most anterior plane of the side view is that of the shoulder (Fig. 5, A); in the front view (Fig. 5, B) that of the breast or abdomen. The mid-plane of the planes in view when the side is turned toward the camera (Fig. 5, A) is a little more anterior than when the front (Fig. 5, B) or back is presented to the camera. (Note relations of these planes as charted in space between A and B, Fig. 5.)

The mid-plane of these mid-planes is, therefore, elected as the preferred plane of focus. As a working rule, the preferred focus may be said to be that of the nipple when the side is presented to the camera, and of the eye, pubis, and small toe when the subject faces the camera. The plane described is about three and one-third inches in front of the centre of the pedestal and subject, and it should be fixed for all records intended for comparison.

Speed of Exposure. As few subjects can remain photographically still, the place selected as a studio should be sufficiently well lighted to permit 0.5 and 0.35 second exposures. This practically necessitates full-glass lighting in two directions and the use of reflecting screens. Those engaged in photo-records are nearly always associated with hospitals, where a glazed corridor, porch or sun parlor is usually available for this work. In a series of views taken at a sitting, more uniform results can be obtained by uniform speed of exposure. The speed indicator of the shutter should be inspected before each release, since it tends to creep faster with the jar of each successive exposure.

Contact-prints from negatives made at different times, of the same children at different ages, or of different individuals of different statures, and taken in the manner already cited, are

The Preferred Plane of Focus = the Mid-plane of the Antero-Median and Latero-Median Mid-planes.



In Lateral View, Mid-Plane Passes Through the Nipple.

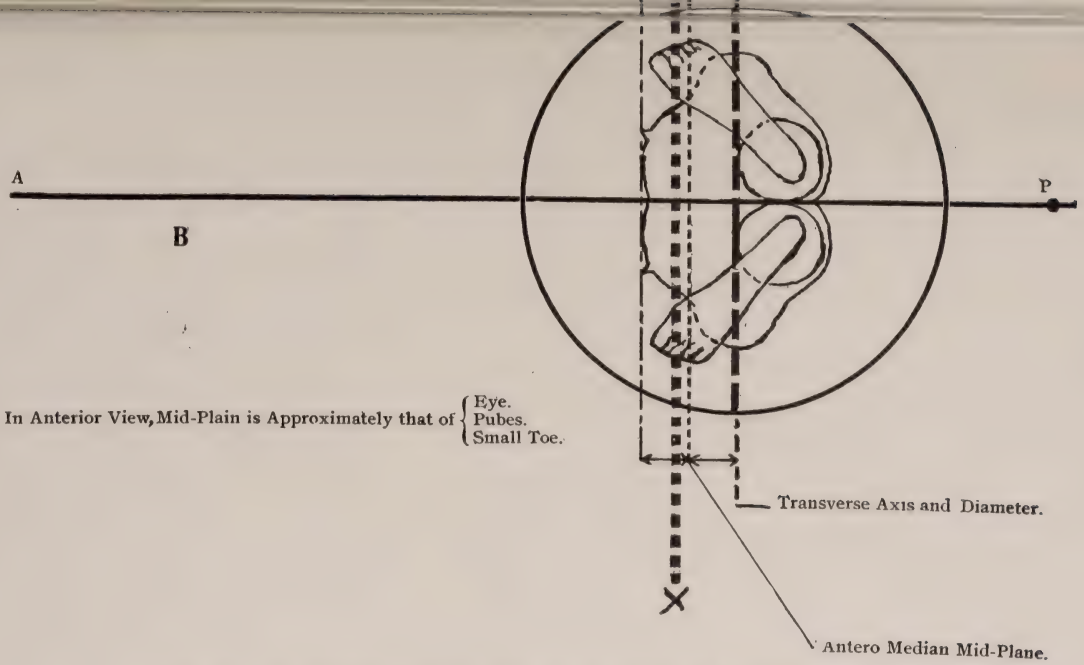


FIG. 5.—The preferred plane of focus, the mid-plane of the planes in view.

suitable for accurate comparison in so far as uniformity of condition is concerned, but the photographic images will be of different sizes because, although made at the same distance, they represent individuals of varying heights, and are therefore only serviceable for the study of actual differences in development of the same subject at different periods, or of the actual individual differences existing between different subjects. Prints by enlargement or reduction[1] giving all subjects the same stature must be made when it is desired to study relative changes in development in the same subject at different times or the relative development of different subjects.

One not versed in photographic distortion would be inclined to suggest that all subjects should primarily be made the same size on the negative, forgetting that this would entail varying distances of the camera from the subject, and, consequently, varying degrees of distortion.

Pose. As pose may magnify or minimize physical abnormalities, the honesty of records for comparison—either with earlier or later records of the same subject, or with records of other subjects—demands that cases recorded should be identically posed on each occasion of record in the habitual standing posture, and records made of the back, front, and of each side. These views should immediately be duplicated by those of the best corrected posture attainable at the time. As scoliosis is frequently associated with asymmetry of station, all views should be full-length. A complete record of a scoliotic will include the keynote postures as well as those of suspension and recumbency. It is to be regretted that not only advertising physical culture magazines but also reports of treatment of scoliosis in the most respected of surgical publications should contain contrasting illustrations limited to views of patients in the most faulty attitude at the beginning of treatment and in an attitude of forced correction after a period of treatment. Such illustration not only risks the misleading of the unobserving, but it fails to enlighten the orthopedist whether the improvement is merely one of posture or also one of treatment.

[1] This enlargement or reduction does not produce distortion, because the negative is a plane surface

Expense. As a full-length view of the human figure occupies only one-half the breadth of the photographic plates on the market, the expense of photo-records may be reduced one-half by cutting the plates lengthwise in half and using a half plate for each view.

Charts. Where squares are used to help the eye in comparing photo-records it is preferable to obtain them by making a double print, thus making their presence optional, than to photograph the subject through a screen,[1] thereby making the plotted line permanent, and so limiting the utility of the negative. There are many anthropometric and art canons and moduli. The division of human stature and, when symmetrical, of the distance apart of the finger-tips when the arms are extended from the side, into twelve units, as advocated by Page,[2] is a convenient one. He plots the human figure, with arms laterally extended, on a chart twelve squares broad and high. The number twelve is particularly available in the expression of proportion because divisible by 2, 3, and 4. For estimating scoliotic changes, one-twelfth of the stature is too large a unit of measurement, but a half of one-twelfth (one-twenty-fourth) is of convenient size. The measurement of scoliotic deformity in terms of fraction of the stature gives a relative idea of the degree of deformity. The use of squares plotted to one-twelfth or one-twenty-fourth of the stature will not only permit surgeons to illustrate their cases so that they may be accurately compared, but as one-twelfth is an ideal standard it will permit observation of the relation of individual proportions to the ideal.

The method described only secures uniform results for each photo-recorder. The same principles can be applied in recording views from above downward, and from below upward by those who can command the facilities for such observations under the conditions detailed.

[1] When the screen is in focus, the subject is not, and vice versa; again, the divisions of the screen are fixed and bear no relation to the proportions of the subject.

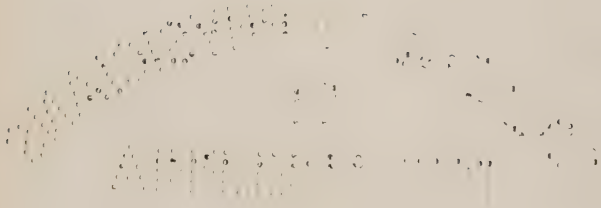
[2] "The Measure of a Man," by William Page, Scribner's Monthly, 1879, vol. xvii., No. 6, p. 894.

If those interested in this topic could agree upon:

1. A standard focal length of lens;
2. A standard focus and distanc eof subject from lens front;
3. A standard direction of lighting for recording purposes;
4. A standard size of image and of division of chart for comparative illustrations; and
5. A standard series of poses in faulty habitual and also in corrected postures, standing, recumbent, and suspended; then the records of *different* observers would permit accurate comparison.

A Supplementary Report will publish anthropometric and orthopedic photo-records made in the method described and showing by metric and inch scales the lengths and diameters of the figures portrayed.

By means of a mirror and a glass plate, the circumferential contours and the diameters of the pelvis and hips and of the thorax and shoulders, both normally and in scoliotic rotation, as seen from below and from above, and in the vertical axis of the subject, will likewise be presented.



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APPENDIX.

THE PUBLISHED WRITINGS OF THE PRESENT ACTIVE MEMBERS OF THE ASSOCIATION.

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